Gardening Opportunities as a Part of the Khwe San People's Food Security in the East Bwabwata National Park

Laura Mäkelä
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Faculty	Department
Faculty of Agriculture and Forestry	Department of Agriculture Sciences

Author
Laura Mäkelä

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Abstract
The Khwe San, the residents of Bwabwata National Park (BNP), were hunter-gatherers who used to acquire their food by hunting and collecting veld food in the past. However, they are not allowed to practice their traditional methods anymore due to the status of the park as a national park and the army trying to prevent increased poaching in the bush. Nowadays they are highly dependent on food aid provided by the Namibian government. In addition, small-scale subsistence agriculture is practiced but due to drought and wild animals, harvests are insufficient to meet required food demand on a daily basis.

The objective of this research was to investigate gardening opportunities of the Khwe San in the Eastern part of BNP. The data were collected through semi-structured interviews with 38 respondents and several stakeholders. Four different groups were found which were home gardeners, community gardeners, participants of gardening workshop and non-gardeners. The data were analysed using a thematic content analysis, a SPPS statistic programme and a sustainable rural livelihoods framework. In addition, one positive deviance gardener was selected, and his production methods is described in more detail.

The main results highlighted the importance of having gardens. All the respondents indicated that gardening is important or very important in terms of food production and income generation. However, the majority of the residents are willing to have home gardens due to the challenges of community gardens in the past e.g. the lack of cooperation, jealousy and stealing as well as the lack of needed goods. Current challenges are that there are only one or two water sources in each village and the distances from the boreholes to gardens are long, which complicates irrigation. In addition, poor fences and lack of seeds and tools are the major challenges that home gardeners face. Future training should include specific things because the interviews showed that the general gardening knowledge is presented.

As a conclusion, the focus of gardening should be on home gardens, not on community gardens due to their challenges. However, in order to make gardening sustainable, several activities need to be addressed, including an active agriculture extension officer for monitoring, training on specific things and seed distribution provided by the government. In addition, the gardening support needs to be aimed to dedicated people who are willing to practice gardening.

Keywords
Home garden, community garden, food security, Namibia, indigenous people

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Tiivistelmä
Bwabwatan kansallispuiston asukkaat khwe sanit olivat ennen metsästäjäkeräilijöitä, jotka hankkivat ruokansa metsästämällä ja keräilemällä villiruokaa. He eivät kuitenkaan enää voi harjoittaa heidän perinteisiä ruoanhankintamenetelmiä, koska se on kielletty kansallispuistossa. Lisäksi armeija on alueella estämässä norsujen salametsästystä, jonka seurauksena asukkaita on kielletty menemästä metsään. Khwe sanit ovat riippuvaisia Namibian valtion tarjoamasta ruoka-avusta. Pienimuotoista maanviljelyä harjoitetaan jonkin verran, mutta kuivuuden ja villieläinten aiheuttamien vahinkojen vuoksi se ei ole riittävää täyttämään päivittäistä tarvetta.

Tutkimuksen tavoitteena oli selvittää khwe sanien mahdollisuudet puutarhaviljelyyn kansallispuiston itäisessä osassa. Aineisto kerättiin puolistrukturoiduilla haastatteluilla. Yhteensä 38 khwe sania haastateltiin sekä useita sidosryhmien jäseniä. Neljä erilaista ryhmää tunnistettiin, jotka olivat yksittäiset puutarhurit, yhteisöpuutarhurit, puutarhakoulutukseen osallistuneet sekä kokemattomat puutarhasta kiinnostuneet henkilöt. Aineisto analysoitiin temaattisella sisällön analyysillä sekä tilasto-ohjelmalla. Myös sustainable rural livelihoods -menetelmää käytettiin kokonaiskuvan saamiseksi. Lisäksi haastattelujen aikana löydettiin yksi puutarhuri, joka on onnistunut erityisen hyvin puutarhaviljelyssä. Hänen tuotantomenetelmiään tutkittiin positiivisen devianssin osalta yksityiskohtaisemmin.

Tärkeimmät tulokset korostivat puutarhojen merkitystä ruoantuotannon ja tulojen muodostumisen kannalta. Suurin osa vastaajista haluaa oman puutarhan eivätkä osallistua yhteisöpuutarhaan edellisten ongelmien takia, joita olivat yhteistyön puute, kateus ja varastelu. Myös tarvittavien työkalujen puute oli merkitsevä tekijä. Yksittäisten puutarhojen kastelua vaikeuttaa vesilähteiden vähäisyys ja pitkät välimatkat niiden ja puutarhojen välillä. Myös siementen ja työkalujen puute vaikeuttaa viljelyä. Koulutuksen tulisi pitää sisällään yksityiskohtaista opetusta, koska haastattelut toivat esiin yleisen tietouden puutarhaviljelystä

Johtopäätöksenä voidaan todeta, että keskipiste pitäisi olla yksittäisissä puutarhoissa eikä yhteisöpuutarhoissa. Jotta puutarhaviljely olisi kestävää, alueella tulisi olla aktiivinen maatalousneuvoja, monitorointia, koulutusta sekä siementen jakelu valtion toimesta. Apu tulisi osoittaa omistautuneille henkilöille.

Avainsanat
Puutarhaviljely, yhteisöpuutarha, ruokaturva, Namibia, alkuperäiskansa

Säilytyspaikka
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ABBREVIATIONS

BNP	Bwabwata National Park
GRN	Government
IRDNC	Integrated Rural Development and Nature Conservation
KA	Kyaramacan association
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
MLR	Ministry of Land and Reform
NGO	Non-governmental organisation
OPM	Office of Prime minister
SDP	San Development Programme

1 INTRODUCTION

Despite the rich and unique traditions and cultures of indigenous people, they are one of the most vulnerable people in the world (IWGIA 2017). Traditional dietaries of indigenous people have changed rapidly worldwide (Kuhnlein & Receuver 1996). Nowadays they mainly rely on subsistence agriculture and food aid (IWGIA 2017). Namibia has several indigenous groups of people living in the country. One of the groups is the San which include the Khwe. In the past the Khwe have been hunter-gatherers moving around and acquiring food by collecting veld food and hunting animals. Nowadays agriculture activities such as crop and livestock production have become a part of their livelihoods (Hitchcock et al. 2006). The number of the San in Namibia ranges between 27 000 and 34 000 (IWGIA 2017).

1.1. The Residents of Bwabwata National Park

Bwabwata National Park (BNP) is located in Northeast Namibia in one of the poorest regions of the country, in Zambezi and Kavango regions (Republic of Namibia 2015). BNP consists of two different political regions, which means that the people have to report to different head places of the regions, which are far from each other and in different time zones (MLR 2015). There are currently approximately 5,500 people living inside the park (MLR 2015). These people are not only poor but also deprived. They lack living environment, material, education, employment and health (Republic of Namibia 2015). The majority of the residents are the Khwe San, but other tribes are also present. BNP is divided into different zones, and one of them is a multiple use area where the residents of the park live and permitted to practice agriculture. Due to the status of the area as a national park, hunting is not allowed anymore (MET 2013). This complicates obtaining food among the Khwe because they cannot practice their traditional food acquiring methods. Due to increased poaching (IWGIA 2017) and the army in the bush trying to prevent it (Namibian Sun 2017), the residents are forbidden to go further than 5 km into the bush to collect veld food.

1.2. Livelihoods

Veld food has always been an important source of food for the Khwe and its participation in food security has been important (Suzman 2001 & Boden 2014, Dain-Ownes et al. 2010). The food collected from the bush, including fruits, seeds and roots, are used as relish (side dish, often eaten with maize-meal or rice) and medicines (Dain-Ownes et al. 2010, Dan et al. 2010). Nowadays women are looking after children while they are preparing food for the families (Jones & Dieckmann 2014). Women also participate in collecting veld food. However, in the past, women were not involved in contributing to the economy of a family, while young men were hunting and working to raise income and purchase demanded goods for a family (Jones & Dieckmann 2014).

The Khwe are in a constant battle with lack of money because there are very few income sources in the area. The main income sources are pensions (Suzman 2001) and vulnerability payments, as well as small piece work (Jones & Dieckmann 2014). However, not all of the elderly people receive these pensions because they lack birth certificates (Suzman 2001). The registration can only be made in bigger cities such as Katima Mulilo, but, registration is difficult due to their inability to speak and write English and high transportation costs (Jones & Dieckmann 2014). In addition, the harvest of devil's claw, *Harpogryphytum procumbens,* has been an important income source for the Khwe (Jones & Dieckmann 2014). The harvest time of devil's claw reaches between March and October (Msangi 2014).

Agriculture is allowed to be practiced in the multiple use area. Despite the past hunter-gathering livelihoods activities, agriculture has become popular among the people, especially among the elders, however, their farming experience is limited (Republic of Namibia 2015). The Khwe practice subsistence agriculture in small-scale (Suzman 2001, Jones & Dieckmann 2014), which can be divided into crop cultivation and livestock rearing. Crop cultivation is rainfed, which means it is highly dependent on the rainfall. The main crops are maize, millet and vegetables (Jones & Dieckmann 2014). The fields of the farmers are not fenced, and they are far from the villages. This causes challenges with wild animals such as elephants and baboons (Boden 2014). The farmers do not have many ways to prevent damages done by wild animals. The biggest threats are the elephants due to their size and difficulty of chasing them away (Boden 2014). Furthermore, the farmers do not possess proper tools for farming which makes it

physically demanding (Jones & Dieckmann 2014). The Namibian government supports crop cultivation by providing ploughing services and seeds for the farmers who have registered (Boden 2014).

Their domesticated animals are goats, chickens and donkeys, which are held mainly for money. Livestock is sold in case there is a need for covering transportation costs or school fees (Boden 2014). Cattle are not kept in the East BNP due to veterinary restrictions (Jones & Dieckmann 2014), and only few people are using donkeys for carrying goods and water.

1.3. Policy

There are several governmental and non-governmental organisations (NGOs) working towards sustainable livelihoods in the park through different activities, such as development programmes. The Ministry of Environment and Tourism (MET) is officially in charge of how the land is used in the area (MLR 2015). The Ministry of Land and Resettlement (MLR) coordinates a project "Western Zambezi Group Resettlement Project", the aim of which is to ensure food security of the San and improve the livelihoods through services such as seed distribution and ploughing services as well as boreholes (MLR 2015, Jones & Dieckmann 2014). Another programme, the San Development Programme (SDP), was established by the Office of Prime Minister (OPM) in 2005. The aim is to support sustainable livelihoods through programmes, education and income generation among marginalised communities. Integrated rural development and natural conservation (IRDNC) has helped the Khwe providing trainings on basket weaving and helping to get access to basket markets (Boden 2014). IRDNC is also helping the Khwe with permit issues and sustainable harvesting methods of devil's claw. The permit for harvesting and trading is acquired from MET (Msangi 2014).

The GRN provides food aid through the San feeding programme, drought relief and the school feeding programme (Jones & Dieckmann 2014, Boden 2014) which include mainly maize meal, rice, cooking oil and tins of fish. However, the food aid is not very nutritious, and it increases the San's dependency on food aid (Boden 2014).

The residents of the BNP have the legal body, the Kyaramacan Association (KA), representing them. It was established in 2005 and officially recognised by MET in 2006

(Jones & Dieckmann 2014). The responsibilities of the KA include managing the communal income coming from tourism and trophy hunting in the park as well the harvest and sale of devil's claw (Boden 2014). In addition, the KA helps the residents to communicate with the GRN and other officials. (Jones & Dieckmann 2014).

There have been several community projects to improve the livelihoods organised by the GRN, e.g. community garden projects in Omega III and Chetto, bakery project in Mashambo and bee keeping projects in Ketchentce (Boden 2014). However, neither of the community garden projects, established in 2007 by the Office of Prime Minister (OPM), are operating any longer due to various reasons e.g. vandalism, lack of gardening knowledge and jealousy (Boden 2014).

1.4. Food Security

Food security among the Khwe is not achieved with currently practiced livelihood activities. Due to the variety of challenges e.g. drought, insufficient food, dependency on GRN, prohibition of the bush and illegal hunting, new solutions to diversify the diets and food security of the Khwe are needed. According to the World's Food Summit (1996), "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life". Today, this does not exist among the Khwe in BNP. According to Msangi (2014), hunger results from poverty and the causes are many, including e.g. bad GRN policy, unequal income distribution and the lack of resources. The Khwe are highly dependent on food aid provided by the GRN. Crop cultivation is extremely difficult due to mentioned challenges; hence small-scale gardening could be an option to diversify the diets of the Khwe because it plays an important role in food security and livelihoods in developing countries (Marsh 1998). It can also remove the challenge of long distances and damages done by elephants. Gardening is already practiced in BNP, but it is not common.

2 GARDENING IN SUB-SAHARAN AFRICA

Gardening is seen as a potential activity to improve the livelihoods in rural areas (Marsh 1998). Due to changing climate, many countries face droughts in sub-Saharan Africa, which, again, has an impact on food availability. Different kinds of gardening projects are introduced in order to help poor families in rural areas to meet their food security. Furthermore, gardening projects are promoted as tools for poverty alleviation (Marsh 1998).

There are several different types of gardens found in sub-Saharan Africa. These gardens include e.g. home gardens, community gardens and school gardens. The production methods of these gardens are quite similar to each other, regardless of the type of a garden. Each garden type mentioned is described below.

2.1. Home Gardens

Characteristics of Home Gardens

Home gardens (also known as kitchen gardens and backyard gardens) play an important role in hunger and malnutrition alleviation (Galhena et al. 2013). The contribution of home gardens to food security has been important globally (Niñez 1987). Home gardens' impact on food security is profoundly studied (Tesfamariam et al. 2018, Adekunle 2013). The gardens provide food directly from the field to consumption on a daily basis (Marsh 1998). These kinds of gardens are important especially for people who are poor since establishing home gardens do not require large inputs or fields (FAO 2004). Frequently, many of the resources are locally available (Marsh 1998).

Home gardens are areas which are either nearby the household in short distance or around the house (Marsh 1998). Typically, home gardens are located near a water source which can be for instance a borehole or a river (FAO 2004). However, gardening plants can be even planted in containers (Marsh 1998). Other production methods, such as keyhole gardens, have been introduced to produce fresh vegetables in dry areas. Keyhole gardens are good due to their capability of holding moisture well (Mokitimi et al. 2009). In addition, borehole-garden permaculture is a method where split water is utilised for irrigation (Rivett et al. 2018).

The purposes of home gardens vary (FAO 2004), the most common purpose being the supply of nutritious food all year round, as well as the income generation by selling garden products. The contribution of home gardens to manage wastes coming from household is seen positive (FAO 2004). By composting household wastes or using waste water on gardens help maintaining recycling in the household (FAO 2004).

The typical characteristics of home gardens include a high plant diversity, but a small production area as well as low inputs (Niñez 1987). The typical technology used is simple, such as hand tools. Family members are frequently assisting in a home garden. Home gardens can be also part of the agroforestry systems when cultivating, for instance, fruit trees in the same area (Gliessman 2014). The size of this kind of gardens ranges from smaller than 0,5 to 2,0 hectares (Gliessman 2014). Gardens are often fenced by utilizing locally available materials such as branches and thrones (Thompson et al. 2010). Also, living hedges are seen to protect gardens. The importance of a fence is high due to grazing animals which can easily graze the harvest without any protection (Thompson et al. 2010). The lack of a fence is one of the challenges that gardeners face (Zimpita et al. 2015).

Home gardens are often seen as a mixed cropping system, including not only edible vegetables but also herbs, fruits, medicinal plants and livestock (Gautan et al 2004, High & Schackleton 2000). The selection of cultivated plants varies in gardens. Frequently, the selection is made based on physiological properties and market demand (Torimiro et al. 2016). In addition, the needs and interests of households are part of the choosing. These can be, for instance, food production only for own consumption or income generation. The harvests from home gardens are either consumed by the family, or part of it is sold (Torimiro et al. 2016, High & Schackleton 2000).). The income is often used to pay necessary things such as school fees and transportation costs (Boden 2014). There are ecological benefits, such as nutrient recycling, due to diversity of home gardens (Galhena et al. 2013). Livestock can be integrated to home garden systems by providing manure as well as improving family nutrition. The use of organic manure improves soil structure and the moisture level, and it also increases organic matter in soil (Haynes 1998).

Constraints of Home Gardens

Despite many positive impacts of home gardens, there are also constraints and limitations in production. Environmental changes such as drought and floods affect home gardens rapidly. The lack of water is one of the major challenges and it can be a limiting factor in successful home gardens (Zimpita et al. 2015, D'Haese et al. 2013). Sometimes boreholes might not function properly due to pump breakages or lack of fuel (Hart 2011). The distances from home to a water source can be long. Collecting water for irrigating is hard and time demanding (Faber & Laurie 2011). In a research about African vegetables in South Africa, the gardeners did not have the knowledge of how to keep moisture in garden beds or utilize grey water (household's waste water) for irrigation (Hart 2011). A drip irrigation is seen to be an effective method in gardening. Establishing the drip irrigation system might be expensive first, but the harvest grown afterwards is larger. Hence, the costs are high at the beginning but, in the end, the money will be returned through larger harvest (Postel et al. 2001). Increased harvest may have effects directly on the food security of a household (Postel et al. 2001).

Small-scale gardeners often do not have inputs or knowledge to prevent insects and disease on their gardens (Torimiro et al. 2016, Zimpita et al. 2015). Low pest and disease management might reduce the quantity of harvest as well as its quality. Poor families do not have money to purchase pesticides; hence they must have to find other ways to prevent them. Traditional practices in pest management include crop rotation, use of repellent plants, removing grasshoppers by digging and traps (Abate et al. 2000). Also, sand is used against ants and pest control is done manually, which means collecting insects by hands (Hoogerbrugge & Fresco 1993). Removing dead leaves occurs also. Botanical insecticides is an old method used for crop protection (Isman 2007). It is usually made from natural products such as pepper and garlic (Fening et al. 2014). Overall, the pest control is mainly preventive methods (Nyamwasa et al. 2018).

There are many sources for acquiring seeds (Zimpita et al. 2015). Gardeners can purchase them from markets or save seeds from the harvest. If seeds are harvested, it is important to know whether they are hybrid seeds because they might not grow well (Sukprakarn et al. 2005). However, the majority of the gardeners in the rural area of South Africa got their planting materials from a community-based nursery (Zimpita et al. 2015). Only few gardeners received their seeds from an agricultural extension officer. Although the sources for getting planting materials are many, very often home gardeners are lacking

the seeds due to their high price (Faber & Laurie 2011). The World Vegetable Center has developed disaster relief seed kits where vegetable seeds are distributed for vulnerable communities in a case of natural disaster (AVRDC 2018). The seeds are fast-growing and nutritious. In addition, home garden seed kits are used for promoting home gardens.

Gardening training and extension services are an important source of gardening knowledge. Gardening knowledge can be taught for instance at demonstration gardens. Demonstration gardens can act as training centres, where each step of gardening is demonstrated. (Faber & Laurie 2011). However, small-scale gardeners are often lacking the extension services and gardening knowledge (Zimpita et al. 2015). People often learn from each other by adapting activities (Foster & Rosenzweig 1995).

2.2. Community Garden

A community or communal garden is a cultivation area managed by a certain number of people or groups. African community gardens have been initiated mainly due to changing climate to improve food security of households (Matsa & Dzawanda 2014). Community garden members usually have a mutual goal of gardening (Parry et al. 2005), such as income generation or food production or to gain gardening knowledge. There can be several working arrangements in community gardens. Typically, a community garden can be divided into different plots where there are commercial plots for income generation and personal plots for home consumption (Cadger & Kepe 2013, Chazovachii et al. 2013). The typical markets of community gardens are nearby households and shops (Sithole et al. 2012) and the selection of participants is often done by the community (Ward et al. 2004).

Numerous studies about community gardens are conducted in sub-Saharan Africa. The challenges of community gardens are similar to each other. These challenges include both social challenges as well as management challenges. A research on community garden in the Maphephetheni uplands (South Africa) found that the gardeners failed to grow enough vegetables for own consumption due to crop theft, drought and damages done by animals (Shisanya & Hendriks 2011). The location of the community garden was far from their homes; hence the guarding of the area was difficult.

The challenges in production and growing are similar to those of home gardens. The major challenges such as water, pests and livestock occur very often in community gardens (Cadger & Kepe 2013, Chazovachii 2013, Shisanya & Hendriks 2011). Often community gardeners do not have pesticides or money to buy them to prevent insects. Water is a challenge among the gardeners. Often the distances are long, and the gardeners do not have ways to carry water (Cadger & Kepe 2013). In some cases, boreholes are too heavy to pump water and the gardeners get tired fast (Chiwanza et al. 2015). Breakages of boreholes may cause challenges for irrigation (Ward et al. 2004).

If the garden is not fenced, animals can easily get inside the garden and graze the harvest. Challenges with a fence was found in a research in community gardens in Zimbabwe (Chazovachii et al. 2013) and in Botswana (Cadger & Kepe 2013). In addition, the lack of cooperation among the participants, marketing challenges and poor management occurred in the community garden in Zimbabwe. Parry et al. (2005) found that community gardens are more about the people in a community than practicing gardening. The goal of the community gardens was unclear for the San gardeners in Botswana (Cadger & Kepe 2013). Furthermore, some of the vegetables chosen, such as green pepper and lettuce, were unfamiliar to the San.

Different researches show that the outcome of the community gardens has had only minimal success (Ward et al. 2004, Shisanya & Hendriks 2011, Cadger & Kepe 2013). The sustainability and continuity of community gardens is seen to be low (Ward et al. 2004). Shisanya & Hendriks (2011) found that contribution to food security was not significant and Matsa & Dzawanda (2014) found that the community gardens in Zimbabwe started to collapse soon after the managing NGO left. However, the impact of community gardens on food security was good while the NGO was monitoring it.

2.3. School Gardens

School gardens are areas where not only vegetables, but fruits can be grown by the help of learners. Location for school gardens are around schools or nearby (FAO 2010). Furthermore, domesticated animals can be integrated in gardens as well. The purpose of establishing a school garden has been different in the past. The main goal was to produce food for their own consumption at schools and homes or to create income (FAO 2010). Increased food insecurity due to climate change and increasing food demand has changed

the aim of the school gardens towards improved nutritional knowledge (FAO 2010). The targets of school gardens are not only learners but their communities and families as well (FAO 2010). Okiror et al. (2011) found that school gardens can also improve families' nutrition and income in rural areas.

School gardens can have many positive impacts (FAO 2010). Pupils' knowledge about growing vegetables and other products increases and improves lives of the families. Harvest from school gardens is often used by pupils as school meals (FAO 2010). In addition, learners might start gardening at homes or spread gardening information to their parents as well as help them with their gardens (Laurie et al. 2017, Okiror et al. 2011)

Working arrangements vary in school gardens. Typically, pupils are helping in different phases of gardening, such as weeding and harvesting (Beery et al. 2014, Laurie 2017). Someone needs to be in charge of the school gardening and lead it (FAO 2004). A school principal, a teacher or a community member who owns gardening experience may be the leader of a school garden. Schools often get their funding for gardens either from school funds or from outside organisations e.g. charity organisations or NGOs (Laurie et al. 2017). School gardens need inputs such as tools, fence and labour, just like any other garden. In order to maintain a school garden successfully, teachers require necessary skills which include not only the management of theoretical skills but also the practical skills (Sottile et al. 2016).

School gardens face similar challenges with home or community gardens and those challenges are pests, lack of water, stealing and domesticated animals (Mokitimi et al. 2009). In addition, teachers' low knowledge about gardening and the lack of funding influence (Okiror et al. 2011). Similar findings were done by Laurie et al. (2017) in South Africa where they did not have enough funding or technical support in school gardens.

2.4. Socio-demographic Characteristics of Gardeners

The participation of women in agriculture is widely discussed in terms of access to land, financial capital and other resources. The responsibility of women in food production has been high in sub-Saharan Africa (Quisumbing et al. 1995). They are traditionally

responsible for producing food. However, women are lacking land tenures and other resources needed in agriculture in many countries in sub-Saharan Africa (Quisumbing et al. 1995). For this reason, women are often cultivating smaller and poorer areas. They do not often have the same amounts of needed equipment than men do. In addition, they are lacking agriculture extension services including seeds and credit.

Torimiro et al. (2014) found that women participated in vegetable production more than men in Nigeria. Community gardens are often seen as a tool for women to get involved (Marsh 1998). South African female community gardeners were successful providing not only food but also enough vegetables for sale (Sotshongaye & Moller 2000). Low participation of men was also presented in a community gardens in Botswana (Cadger & Kepe 2013) and in Zimbabwe (Sithole et al. 2012). The low participation of men in Botswana occurred due to the lack of payments.

Gardening is often seen as an activity which involves more elderly people than the young. (Igue et al. 2000). Gbedomon et al. (2015) found that young people are less involved in gardening than elder. This might be explained by a low physical effort in gardening. Ngome and Foeken (2012) found that generating income by selling products from home gardens was more important to male gardeners whereas female gardeners clearly indicated the food production to be more important. Also, women were producing food for home consumption in Dar es Salaam (Msangi 2014). At the same time, the youth and the men were selling their vegetables at the markets. The participation of women in small-scale agriculture was high by them doing the majority of the work on the agricultural land in Malawi. However, the men controlled the income coming from the sale of the agriculture products (Msangi 2014). It seems that women are producing food more for the families' home consumption while the preference of men in production is income generation.

3 OBJECTIVES

The aim of this thesis was to determine gardening opportunities of the Khwe San in the East Bwabwata National park and to study what type of garden could be most suitable (if any) for the residents. In addition, more specific research questions are listed below:

- Are the residents willing to have gardens?
- Who are the gardeners?
- What are the challenges and opportunities in gardening in the East part of BNP?
- Why are community gardens not operating anymore?
- What are the enablers of gardening?

4 MATERIAL AND METHODS

4.1. Study Area

The research was conducted in the East Bwabwata National Park in the North-East of Namibia. The Republic of Namibia, sub-Saharan Africa's driest country, is located in Southern Africa (Figure 1). Its neighbouring countries are South Africa in the South and Botswana in the East. Angola and Zambia are in the North. The Atlantic Ocean lies in the West.

The administrative division of the country includes 14 different regions, further divided into local constituencies. The East BNP lays in the Zambezi Region, previously named the Caprivi and belongs to the Kongola constituency. The capital of the region is Katima Mulilo with approximately 28 000 inhabitants. The income rate of Namibia is categorized to be upper middle-income (FAO 2014) and primary and secondary education is free. The poorest regions in Namibia are the Zambezi and the Kavango , exactly those two regions, where BNP is situated. (Republic of Namibia 2015).

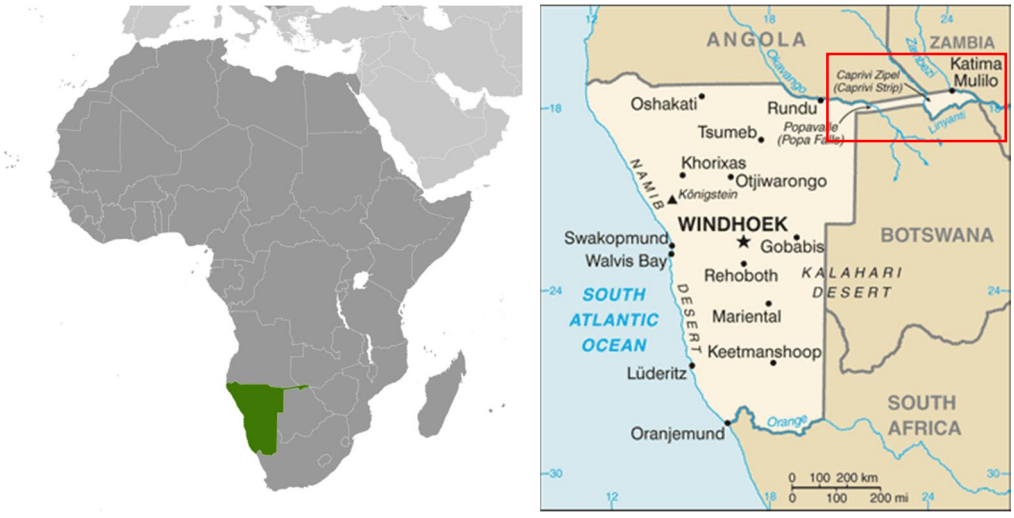

Figure 1. The map of Namibia (The World Factbook 2018).

Agriculture in Namibia can be divided into commercial farming and subsistence agriculture, with maize, millet and sorghum being the main cultivated crops. Due to the country's extreme dry weather conditions, farming proves to be challenging, creating a dependency on South African imports, especially on maize and fruits. The growing period in the study area varies between 100 and 170 days (FAO 2014).

The nearest market towns for the residents of the BNP are Katima Mulilo to the East (160km) and Rundu to the West (200km). The BNP is bordered by the Okavango river in the West and the Kwando river in the East, with the Trans-Zambezi Highway (B8) going across the national park. Divundu is located in the West just at the entrance of BNP and Kongola is outside the park in the East where

History of BNP

The very first people living and moving around the area were the hunter-gatherer San people as early as the end of the 18th century (MET 2013). They have lived relatively undisturbed from outside forces until the first colonial powers arrived in the area. The area has been first proclaimed as a Nature Reserve in 1937. In 1963 status of the area changed, and the West Caprivi Nature Park was established (Boden 2009). Due to an increase in wildlife hunting and the subsequent game population drop, a higher level of conservation protection was needed; hence the area was proclaimed as the Caprivi Game Park in 1968 (Boden 2009; Jones & Dieckmann 2014). The Khwe were permitted to stay and continue their traditional methods to acquire food in the area (Boden 2009).

Following the declaration of the area as a Game Park, the South African Defence Force (SADF) occupied the area and announced it as a military zone (Boden 2009). At that time, no one from the Department of Agriculture and Nature Conservation had access to the area. The SADF established military bases, for instance in Omega and near the Kwando River, also taking charge over nature conservation by employing the Khwe to track and find poachers (Boden 2009).

The SADF allowed the Khwe San to remain but removed the Mbukushu people in 1970 (Jones & Dieckmann 2014). After the Independence of the Republic of Angola (in 1974) number of the Angolan Khwe escaped to Namibia and got affiliated with the SADF (Brenzinger 2000). The SADF have been withdrawed in 1989 and Namibia became independent from South Africa in 1990 (Jones & Dieckmann 2014). At the time of the Independence, approximately 4,000 San were relocated from Namibia to South Africa, Nonetheless, the majority stayed in their home country in Namibia (Boden 2014).

MET conducted a socio-ecological survey which defined flora and fauna and their status in the West Caprivi Strip after the Independence (Brown & Jones 1994). In addition, the survey also included questions regarding the residents of the area and their living

conditions. One of the main outcomes of the survey was to keep the residents in the area and include them in the conservation planning (Brown & Jones 1994). A vision of the North-East parks in Namibia was made in 1998 and approved in 1999. The vision included e.g. zoning the park into three core areas and one multiple-use area as well as the prohibition of cows in the park (MET 2013).

Angola faced a civil war in 2000 which has also spilled overto the West Caprivi. This caused over 1,000 local people to escape to Botswana from Namibia. However, part of them came back to Namibia (Suzman 2001). In 2007 the conservation status of the area had been upgraded to the highest level, establishing the Bwabwata National Park.

Characteristics of BNP

BNP comprises three core areas, Kwando, Buffalo and Mahango (Figure 2) where strict nature protection as well as controlled tourism is taking place. In addition, there is a multiple-use area where the residents of the park live and allowed to practice agriculture. Commercial trophy hunting occurs throughout the whole BNP. The size of the multiple-use area is the largest zone in the park with approximately 5,500 people living inside the national park. Different tribes are represented but the majority of the people, approximately 4,000, are the Khwe.

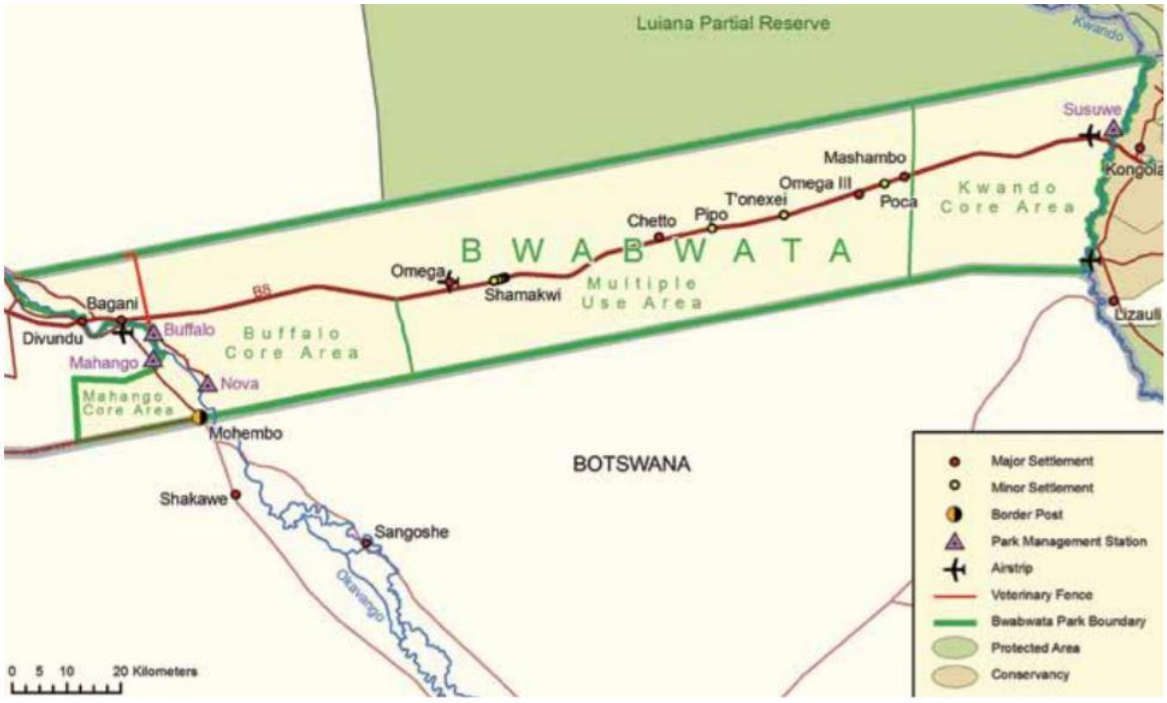

Figure 2. Bwabwata National Park and the zones (MET 2013).

There are two different seasons; rainy season and winter season. The winter season is from June to August and the rainy season from September to April. The highest rainfall is from February to April. One of the greenest places in Namibia is the Caprivi strip due to the highest rainfall of the country. Figure 3 represents the annual rainfall in the East BNP from 2000 to 2016.

The vegetation is mainly Kalahari Woodland (Wingate et al. 2018) with typical trees in the area being Mangetti and Zambezi teak (Msangi 2014). Both large animals, such as elephants and hippos, and small animals, like baboons, are found in the park and the migration route of elephants crosses BNP. In addition, predators such as leopards, lions, cheetahs and hyenas are also found in the park.

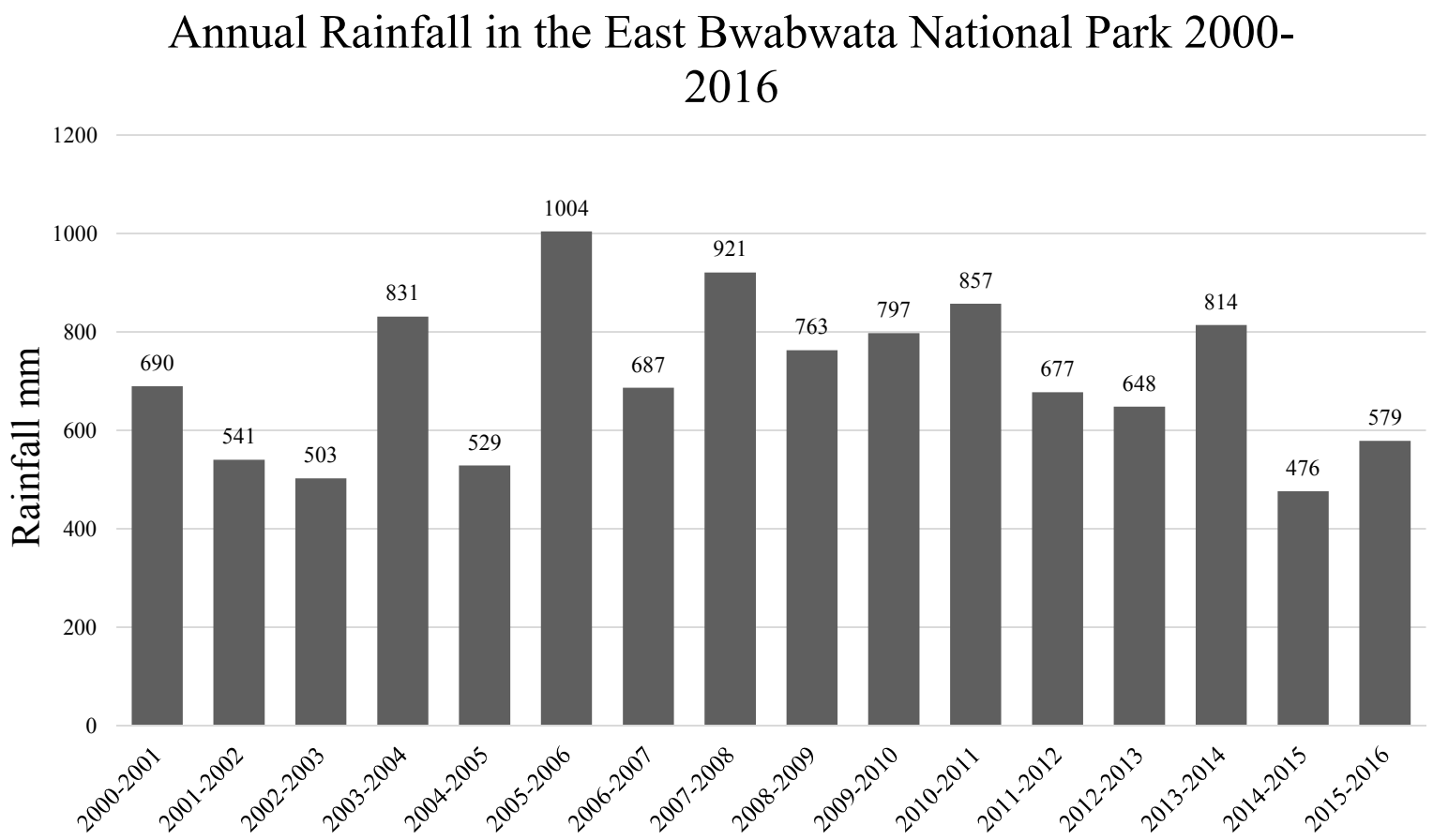

Figure 3. Annual rainfall in BNP East (NOAA Climate Data Record, modified by Attila Paksi)

4.2. The Research Sites

The research area included six villages in the East BNP. The majority of the residents living in these villages are Khwe San. Only Omega III and Chetto have very small number of residents from other tribes. There is no radio coverage in any of the villages.

Mashambo

Mashambo is located near the Kwando core conservation area in the East of the multiple-use area. The population of Mashambo is 215 people. The distance to the nearest town, Katima Mulilo, is approximately 155 kilometres. The local Primary School, where teaching takes place in English accommodates learners from grade 1 to grade 5, for higher grades local students attend the school in Omega III. There is a hand pump for fetching water and a rarely used diesel pump. A variety of projects have been introduced to the village, including a bakery and a craft centre, however, these were not working at the time of research. The village is not connected to the electricity grid, only small solar panels are used for basic electricity needs, such as charging phones.

Poca

Poca is located near Mashambo in the West. The population of Poca is 70 people. There is no school, but the pupils either go to Mashambo or Omega III, depending on the grade. Poca has one solar pump supplying water for the residents of the village. There is no electricity; thus, the residents are using solar panels.

Omega III

The population of Omega III is 400 people. There are two water pumps in Omega III. One of them operating with solar panels. The local Ndoro Memorial Combined School teaching students from grade 1 to grade 10, also uses English as the language of instruction. There is also a student hostel, and a school garden has been established in 2017. At the time of the field research an extension officer was operating in the area employed by the Ministry of Agriculture. There is an abandoned community garden, a police station and a shebeen (local pub). There is no electricity, but solar panels are used, for instance, at the school.

Tonxei

Tonxei is next to Omega III in the West. It is a small village and its population is 65 people. There is a hand pump for water. The learners go to school at Omega III.

Pipo

Pipo is located between Tonxei and Chetto. The population of Pipo is 70 people. The learners go to school in Chetto. There is one water hand pump. There was a community garden a few years ago but it is no longer in use.

Chetto

Chetto is located in the middle of the multiple-use area in the West side of the Zambezi Region. The population is 580 people. There is a Chetto School where teaching is in English. Chetto has its own clinic where simple treatments, such as malaria testing and medication etc., are done but there is no ambulance. There are three water pumps, two of which work with solar panels. The distances from homes to water points are long. There have been two different community garden projects and other projects such as a bicycle project.

4.3. Interviewees

The field research started at the end of March in 2017 and the data collection took approximately four weeks, including interviews, GPS mapping and garden observations. The data were collected by using semi-structured interviews (Appendix 1). The interview questions were created in advance in Finland before conducting the field research but soon after arriving in BNP, the questions had been rewritten according to local conditions and variables. Four different groups were classified based on previous research experience by a researcher working on the ground with the local people. These groups were home gardeners, community gardeners, participants of gardening training and non-gardeners (Table 1). The interviewed people were found with the help of the translators in each village. The translators were familiar with the people and, thus, it enabled sufficient number of interviewed people in short period of time.

Table 1. The interviewed groups in the East BNP

Groups	**Number of interviewees**
Home gardeners	13
Community gardeners	9
Potential gardeners	9
Participants of gardening training	7
Total	38

Furthermore, few administrative officials and representatives of different NGOs were interviewed about the gardening opportunities inside the national park. Also, three agriculture teachers from Mashambo, Omega III and Chetto schools explained what they teach in their agriculture lessons and described the current situation of school gardens.

4.4. Interviews

After arriving in BNP, we stayed in Mashambo for interviews (Appendix 1) with two researchers working in the same study area on different topics. From Mashambo we travelled to nearby villages of Poca, Omega III and TonXei to conduct interviews and visit the community gardens as well as the home gardens. After Mashambo, we travelled to Katima Mulilo whrere we stayed for a couple of days to conduct interviews with the government officials and representatives of NGOs. The next destination from Katima Mulilo was Chetto. Several interviews were conducted in Chetto and two community gardeners were interviewed in the nearby Pipo village.

In each village where interviews were conducted, first I have introduced myself and the aim of the master's thesis to the headman of the village. The permissions for individual interviews were asked with the help of the translators. None of the headmen refused to be interviewed and they shared their experience about past garden projects and described the overall situation of the village.

Before each individual interview, the aim of this master's thesis was explained and permission for an interview was asked orally. Some of the interviews were recorded with Olympus Digital Voice Recorder WS-854, depending on the respondents' language skills. If the respondent was able to be interviewed in English and felt comfortable with it, the interview was conducted in English. Some of the interviews were conducted in English, but in some cases a translator was still there in case the respondents did not understand the question, or they wanted to say something but did not find correct terms to express themselves. However, the majority of the interviews were conducted with the help of the translators in the local Khwedam language. Three translators, identified by the two researchers on the ground, assisted with my interviews.

Several identical questions were asked from all groups in order to discover the opinions about the importance of having gardens and if gardening differs inside the national park compared to other areas outside. In addition, the type of garden wanted in the future was asked from all the respondents.

A pilot interview was conducted in English with a home gardener in Mashambo. After the interview, the questions and their adequacy were discussed with the respondent and some changes were done, for instance, a term 'fertilizer' was changed to 'manure' and 'crop residues' were explained in a more practical as the expression was unfamiliar among the residents. Each respondent was interviewed once, and it lasted from half an hour to one hour, depending on the language used.

After each interview of the home gardeners, they were asked if they can show their garden or where their garden was/will be because the majority of the interviewed home gardeners had not yet started to prepare their gardens. Some of them were still busy at the farm harvesting maize and other crops due the season of crop cultivation. Also, the community garden areas were visited.

The translators were also important sources of information about current situation of the villages and gardening. The time spent with the translators between the interviews and walking long distances from respondent to another, offered time to discuss different past projects and challenges. Also, the two researchers on the ground, who had already spent several years in the area interviewing people and observing the situation, gave a lot of useful insight. The gained data have been triangulated by utilizing the above mentioned

different methods to ensure the validity of the research. Variety of information sources, such as interviews, observations and discussions with the two researchers and the translators, enabled triangulation (Creswell & Miller 2000).

In addition, garden survey among the gardeners was conducted after my field research. It is used as reinforcement information.

4.5. Analysis

Data Preparation

After the field research each interview was either written up or transcribed by using Microsoft Word, depending on how the data were recorded. After this, all data were transferred to a Microsoft Excel file, where all groups had their own sheets. All the interview questions and answers were in the file, which made it easy to compare each answer of the respondents. From the Excel file, results were written up under the certain titles, such as 'the importance of having a garden', 'motivation', 'challenges in gardening' etc. Each group was written under their own titles. Interviews were analysed by using a thematic content analysis and all four groups and the stakeholders were examined carefully. Some of the data were analysed by using SPSS.

In addition to thematic content analysis, a simplified positive deviance method and a simplified sustainable rural livelihoods framework were used to strengthen the understanding of the complex situation as well future gardening opportunities in the Eastern part of BNP.

SPSS Statistics

A cross-tabulation and a chi-square test were used to analyse the data. The analysis was driven by using IBM SPSS Statistics 24 program. However, the numbers of interviewed people in each group were small, hence cross-tabulation and chi-square were only used in questions where all the interviewees answered. Therefore, a statistical testing was not part of this research.

Positive Deviance Approach

One of the home gardeners was found to be unique as his production methods enabled successful harvest. This home gardener is seen as a positive deviant. The positive deviants are people whose activities differ from others in a limited environment. These positive deviants succeed to find behaviours or strategies that allow them to achieve better solutions and results in a similar environment as others (Ochieng 2007).

Sustainable Rural Livelihoods Framework

All four groups of participants were applied to sustainable rural livelihoods framework (Scoones 1998) and the overall picture of restrictive factors in gardening was studied in order to understand the gardening opportunities.

The expression 'Sustainable livelihood' refers to a state when people can cope with stress and shocks as well as they are able to recover from those. According to Scoones (1998), sustainable livelihoods can be reached with an access to different livelihood resources. However, the goal of livelihood strategy needs to be considered. These strategies include livelihood diversification, intensification or extensification of agriculture and migration (Scoones 1998). Formal and informal institutions and organisations have an important role in achieving a sustainable livelihood. All people do not have access to all livelihood resources due to organisational matters and institutional arrangements (Scoones 1998).

Sustainable rural livelihoods' resources are divided into different capitals: social, human, natural, physical and financial capital (Pretty 2008). Social capital consists of different norms, trusts and values in a community (Pretty 2008). Human capital consists of people's skills and knowledge as well as physical capability (Pretty 2008). An access to different services improves human capital. These services include, for instance, schools and training as well as medical services (Pretty 2008). Cultivated and collected food belongs to natural capital (Pretty 2008). Natural capital also consists of the stocks of natural resources (Scoones 1998). Physical capital refers to infrastructure such as roads, markets, tools and other human-made materials as well as transportation systems (Pretty 2008).

5 RESULTS

5.1. The Importance of Gardening

The importance of having or getting a garden was significant among the interviewees. All 38 interviewees found that it is important or very important to have or establish a garden. Therefore, they were asked about the main reasons for having or establishing gardens. Provision of relish and increases in their income were most frequently mentioned reasons during the interviews (Figure 4). After a few interviews, it needed to be clarified which one was more important, relish or income, as they were indicated both together frequently. The majority of the interviewees emphasised their equal importance.

One of the community gardeners was very enthusiastic, stating that the entire Namibia will benefit if his garden becomes successful. Two other interviewees emphasised the possibility of other community members buying vegetables from community members and resulting the money to stay in the village. Sixty-three percent of all the interviewees had had a garden before and the majority of them were men. The association between gender and garden owned did not give a reliable result in a chi-square test due to low expected frequencies.

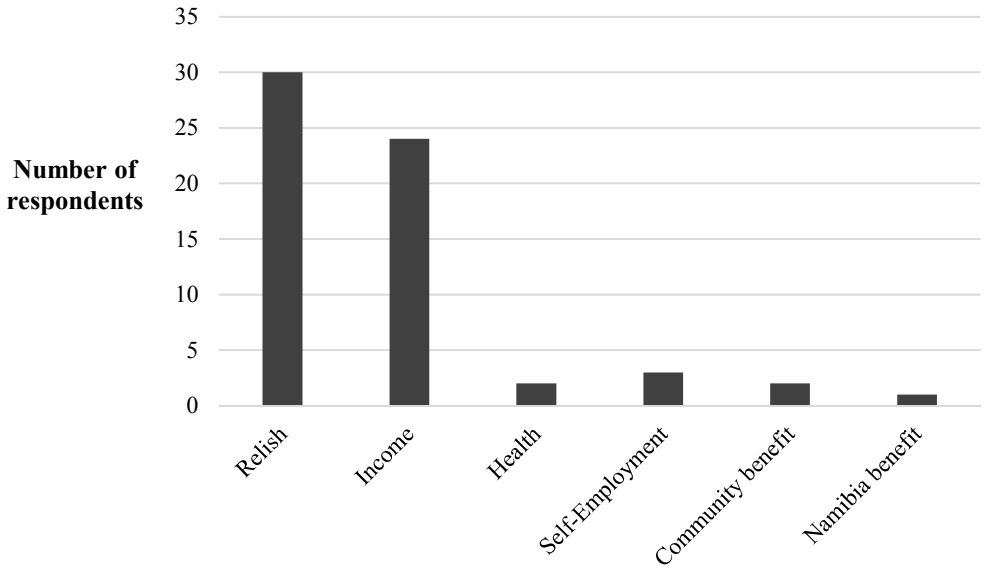

Figure 4. The reasons for having a garden (n=38)

5.2. Home Gardeners

5.2.1. Socio-demographic Data

The average age of home gardeners was 33 years while the youngest was 19 years old and the oldest 67 years old (Table 2). Five of the interviewees had jobs and received salary. In terms of their formal education seven out of thirteen had finished grade 9 or higher. Two of the interviewees had never attended school. Only one of the 13 interviewees was a woman.

Table 2. Socio-demographic data of the interviewed home gardeners

ID	Gender	Age	Village	Job	Grade
1	Male	28	Mashambo	Yes	10
2	Male	21	Mashambo	No	12
3	Male	20	Mashmabo	No	9
4	Male	62	Omega III	No	-
5	Male	19	Omega III	No	7
6	Male	32	Tonxei	No	6
7	Male	27	Poca	Yes	10
8	Male	29	Omega III	No	10
9	Male	32	Chetto	No	9
10	Male	36	Chetto	Yes	4
11	Male	67	Chetto	No	-
12	Male	28	Chetto	Yes	10
13	Female	21	Chetto	No	10

5.2.2. Motivation & Previous Training

The main motivations for starting a garden of their own were to get relish as well as to raise their income. Three home gardeners indicated that they wanted to help the community by selling vegetables to them, particularly, since markets are far from the villages in BNP. Collecting from the bush is prohibited; hence gardeners wanted to get relish from their own gardens. A young man in Mashmabo started gardening because he wanted to grow food for his family members as well sharing the income earned from the

sales with them. Also, the inability to go for devil's claw harvest and earn money was mentioned by one interviewee. Instead of harvesting devil's claw, he secured income by gardening. Few of the interviewees mentioned being able to buy relish as a reason for start growing their own vegetables. A gardener from Mashambo stated:

"Since I started growing in last year April, I did not buy any relish from June up to November."

One gardener indicated that a small garden was for relish and a bigger one for raising income by selling the vegetables. However, the majority of the gardens were established mainly for relish. Income was used either for purchasing seeds or domesticated animals such as chickens and goats.

Only three of the interviewees have received gardening training before, by participating either in community garden projects or workshops organised by NGOs. Nevertheless, the majority has learnt about gardening at schools or while helping family members in community gardens. A few also indicated that there was a school garden in Omega I where they learned gardening activities. Three home gardeners learned how to do gardening at the refugee camp in Botswana in the early 2000s when they had to leave their Namibian homelands due to political conflicts.

5.2.3. Cultivated Garden Crops

The most frequently cultivated vegetable was cabbage. Carrot was grown by ten of the interviewees. Half of the interviewees had grown tomatoes and onions. Also, spinach was mentioned to be grown by five gardeners. Other vegetables mentioned were beetroot, radish and sweet potato. Everyone had grown the mentioned vegetables before, and, in terms of cooking, they know how to prepare them. Fruit trees, such as mango and papaya, were grown in backyard gardens by less than half of the respondents.

The selection of vegetables was mainly made based on their physiological properties, such as fast growing, as well as communities' interests of buying them. Many of the interviewees wanted to grow fast-growing vegetables that can be eaten with a maize meal, and thus, for instance, spinach was chosen. Also, healthiness of vegetables was mentioned

to be important. Eating vegetables was believed to be good in prevention of malaria and other diseases. Especially carrot was grown because it was believed to be good for the eyes. The gardeners in each village stated that the community members like cabbages and they are willing to buy them. Therefore, there was a chance to gain income. A young gardener in Mashambo stated:

"The community likes cabbage. They used to buy cabbages from a business man on high price and I wanted to make it easy to them to buy in low price from me."

Seeds were mainly purchased from a shop in Katima Mulilo, which was the nearest market city. People used to hitchhike to Katima Mulilo and back to buy seeds. One of the interviewees stated that seeds are not expensive but traveling to Katima Mulilo and back costs 200 N$. A gardener in Mashambo bought a package of seeds for 23 N$ while another gardener in Chetto bought a package of seeds for 45 N$. Two of the interviewees received seeds (Figure 5) from an agriculture extension officer and one from a village development councillor. Also, the Namibian Red Cross was mentioned to be a source of seeds by a gardener in Chetto. A gardener in Chetto stated:

"The elders used to receive seeds but not young people."

Figure 5. Hybrid Broccoli seeds in Omega III (Photo: Laura Mäkelä).

5.2.4. Soil Management

The majority of the interviewed gardeners indicated that loam soil was the best for gardening because of its food water holding capacity. However, most of them did not have loam soil in their gardens but sandy or clay soil instead. A gardener in Chetto indicated that he used top soil because of its fertility. Few gardeners stated that they used to bring loam soil into their gardens from nearby places. They mixed loam soil with soil that they had in their gardens and then started sowing seeds.

All the interviewees emphasized the importance of applying manure on gardens. The main reason for using manure was to improve soil fertility; when the soil is fertile, plants grow well and fast. Only one of the interviewees used fertilizers to protect his plants against pests. Ten of the interviewees used goat manure to fertilize the soil. Goat manure was easily available because there were many goats around. Some of the community members requested payment of 10-20 N$ for manure of 25 kg in Chetto but majority gave it for free. One respondent mentioned trying donkey's manure in his garden next season because it was also easily available everywhere. The application amounts of manure varied from 2,5 kg to 12,5 kg per each plot. The size of plots, however, varied between the gardeners. The majority of the interviewees used manure once, just before planting. However, manure was used more if the plants did not grow well and their colour changed to yellow.

Nine of the interviewees knew how to use crop residues. Seven of them had left residues on the garden plot to improve soil fertility. Two gardeners used it for feeding domesticated animals such as goats. Two gardeners had even prepared compost in their garden.

5.2.5. Challenges in Gardening

When interviewees were asked about challenges in gardening, two things were emphasized. Eight out of thirteen indicated that the availability of water and fencing posed a big challenge in gardening activities. Water was far, and gardeners did not have proper tools, such as watering cans, to carry water from the borehole to their gardens. All interviewees irrigated their garden twice a day, in the morning and in the evening. One

gardener in Omega III had an emergency water tank in his garden in case the solar pump broke down. The same gardener also had a water tap connected from the borehole to his courtyard. Only one gardener used his donkeys for carrying water from the borehole to the garden due to the long distance.

Nine out of thirteen interviewees told that their gardens were fenced but they still faced problems with domesticated animals damaging their crops. The gardeners had used poles and branches as building materials in their gardens (Figure 6). However, the gardens were not protected enough against domesticated animals, especially chickens which could easily fly in. Different ways to protect a garden against domesticated animals were mentioned, such as guarding and removing feathers from chickens.

Figure 6. A fenced garden in Chetto (Photo: Laura Mäkelä).

Insects were a challenge for five interviewees, but the majority of the interviewees indicated that they knew what to do if insects were damaging their vegetables. The gardeners used ash or they collected insects by hands to protect their vegetables. Interviewees stated that the ash was an ideal pest repellent as it tasted sour and insect did not like it. One gardener explained that he always cleared the area around the garden to prevent insects coming into his garden. According to one gardener, a sufficient use of fertilizers was a good way to prevent insects. Grasshoppers and ants were considered to be challenging insects.

Other challenges, such as the lack of seeds and tools as well as stealing, were mentioned by two gardeners. All interviewees indicated that they would need more or new tools for gardening. Seven home gardeners possessed a spade. Four interviewees indicated that they owned watering cans but some of them were broken and leaking. Three gardeners mentioned that they did not have any tools. Most of the interviewees mentioned a rake and a digging fork when asked what tools they would need.

5.3. The Positive Deviant Gardener

In this section, the gardening methods and practices of one home gardener is described in detail due to his success and productivity in gardening. He was seen as a positive deviant gardener.

The PD gardener from Omega III indicated his seasonal working. He cultivated crops such as maize and millet during summer season on his fields and vegetables during winter season at his courtyard. His garden was fenced. His family members, especially children, were helping him in different phases in his garden. He had participated in a community garden in Omega III in 2007 where he was one of the managers. In addition, he provided training for the gardening members.

The PD gardener has almost 15 years of gardening experience and participated in several gardening workshops. He has participated on his first gardening training in Botswana while staying in a refugee camp at the beginning of 2000s. Later, he participated in trainings in Katima Mulilo and in Divundu in Namibia. These gardening trainings did not include only knowledge about vegetables but also information about orchards with oranges and bananas. He did not attend school. He mentioned that he had mentored a young gardener to start gardening in Omega III.

Water for irrigation was coming from the borehole to his courtyard. He connected pipes from the borehole to his courtyard and installed a water tap to facilitate irrigation. During the field research he had a water tank in his garden (Figure 7). The water tank was for emergency cases if the water pump or solar pump broke down. This enabled that his plants were not without irrigation for a long time. Irrigation was done twice a day, in the morning and in the evening.

Figure 7. A water tank under the tree for irrigation in case of a breakage of a water pump (Photo: Laura Mäkelä)

The variety of grown vegetables was large. These included e.g. tomato, onion, cabbage, radish and chili. He grew not only vegetables but fruits as well, such as lemon and guava. In addition, a eucalyptus tree and a baobab tree (which were uncommon in the area) were grown in his courtyard. He used to get the seeds from the agricultural extension officer in the past. Though, during the field research he had not received any seeds yet. He also used to purchase seeds that he wanted to grow. He used manure of livestock before planting. In addition, he prepared compost from crop residues (Figure 8) and used it to improve soil quality.

Figure 8. Crop residues for composting making (Photo: Laura Mäkelä).

The harvest from the garden was used either for own consumption or for selling. He sometimes sold his vegetables for other community members. He indicated that his customer base is large, and he even used to sell vegetables for credit for the elder people.

The gardening challenges that he usually faced were the insects and the lack of fencing. The garden survey showed that he applied pesticides against insects on cabbages. The plan for the future was to expand the gardening area, but he would need fencing material for that.

5.4. Community Gardens

5.4.1. Socio-demographic Data

The average age of community garden members was 41 years, the youngest being 29 and the oldest 71 years old (Table 3). All of the interviewees were unemployed and did not receive any salaries during the field research. Only four out of all community gardeners attended school.

Table 3. Socio-demographic data of community gardeners

ID #	Gender	Age	Village	Salary	Grade
14	Female	52	Omega III	No	-
15	Male	34	Chetto	No	10
16	Female	30	Chetto	No	8
17	Female	50	Omega III	No	-
18	Male	47	Chetto	No	-
19	Male	53	Chetto	No	1
20	Male	30	Chetto	No	10
21	Male	49	Pipo	No	-
22	Female	71	Pipo	No	-

5.4.2. Motivation for Participation

The main motivations for participation in community gardens were to get relish and raise income. Some of the interviewees indicated that, at that time when community gardens operated, they did not have relish. Four of the interviewees mentioned empowerment for the involvement. Also, gaining knowledge about gardening was mentioned. Two respondents wanted to get experience from the community garden in order to make a home garden of their own. They wanted to learn how to grow vegetables well.

The reasons for participation of community gardeners from Pipo were their interest in gardening. The founder of the community garden in Pipo was searching for people who were interested in gardening and requested them to join.

5.4.3. Description of Community Gardens

Four different community gardens were mentioned during the interviews: one community garden in Omega III and Pipo and two in Chetto. The Ministry of Agriculture, Water and Forestry (MAWF) established gardens in Omega III and Chetto. Another community garden in Chetto was established by the MLR. Only the community garden in Pipo was started by other than a governmental organization. It was established by a church in 2015 and it operated only for one winter season. Community gardens in Chetto and Omega III were established over 10 years ago. During the field research, none of the gardens were operating (Figures 9, 10, 11 & 12).

Figure 9. & 10. Abandoned community gardens in Pipo (left) and Figure 8. in Omega III (Photos: Laura Mäkelä).


Figure 11. & 12. Abandoned community gardens in in Chetto (Photos: Laura Mäkelä)

5.4.4. Working in Community Gardens

The selection of the participants was made mainly by the community and the headman in Omega III, Chetto and Pipo. There were members from each household in all three community gardens and the selection was made based on people's interest in gardening. The gardening members were working in their own plots within the community gardens in all three villages.

The preparation of each community garden involved all gardening members. They were included in cleaning the area and preparing the plots. Only half of the area was used in the other community garden in Chetto because the soil of the other half was sandy and unsuitable for gardening. The gardening members of each community garden were also helping in fencing the areas. The entire area of community garden in Chetto was fenced although it was not used completely. Community gardens were fenced by using strong wires in Omega III and Chetto. However, the fence was made of branches in Pipo.

The benefits of the community gardens were food, income and empowerment. Some of the gardener members got fresh vegetables from the gardens and sold part of them to other community members. However, there were gardeners in Chetto who did not get any harvest from the garden. Nonetheless, they still expressed their satisfaction with participation. Also, gaining gardening knowledge was seen as one benefit of the community gardens. Two interviewees indicated that there were not benefits at all because people were not paid, and they did not harvest any vegetables.

5.4.5. Cultivated Garden Crops

In all community gardens, members suggested vegetables which they wanted to grow. Communities made their selection based on their interest and prevalence of vegetables. For instance, cabbage was believed to be a common vegetable inside BNP as well as outside. Cultivated vegetable seeds for community gardens were provided by the founder of the projects. However, seeds were distributed only once in all community gardens.

Many different vegetables were grown. Cabbage was the most frequently mentioned vegetable and it was chosen due to communities' preference on them. Other cultivated vegetables were carrot, spinach and tomato. All vegetables were familiar to the gardeners beforehand, except to the gardeners in Pipo. Two of the interviewees in Pipo stated that they were not familiar with all the vegetables, such as cucumber, that were provided by the founder of the project. Furthermore, they were not taught how to use them.

5.4.6. Challenges of Community Gardens

When asked about the challenges in community gardens, several reasons were mentioned. The water was the biggest challenge in all community gardens. There was not enough water for the garden, for other community members and for domesticated animals in both gardens in Chetto where all relied on the same water source. There were conflicts among the gardeners and other community members about water usage as there was no clear agreement about who the borehole was drilled for. However, the solar pumps were drilled for everybody before establishing the community gardens in Chetto.

Some of the interviewees mentioned that the pumps are solar pumps (Figure 13), which had challenges in water availability, especially during a winter season when the heat of the sun was not strong enough to fill up the tanks. The same problem applied to the rainy season when it was cloudy and there was not enough sun. There was a water tap in the middle of another community garden in Chetto to facilitate irrigation. Water was also a challenge for the gardeners in the community garden in Pipo. According to the interviewees, the hand pump was very heavy to use and during the field research it was not well properly (Figure 14).


Figure 13. & 14. The water tank in Omega III (left) and the hand pump in Pipo (right) (Photos: Laura Mäkelä).

Another major challenge was the lack of cooperation between gardening members as well as other community members. Conflicts between the gardeners and the community members affected the outcome of the community garden projects in Chetto, Omega 3 and Pipo. People who were not involved in the community gardens started stealing fence material for building their houses. Jealousy was mentioned by most of the members challenging the cooperation in terms of somebody harvesting more vegetables than others.

The period of harvesting devil's claw was also mentioned as a challenge for community gardens. Some of the gardeners left Chetto for devil's claw harvest because at that time there was a big harvest of devil's claw in the bush. Thieves came and stole vegetables and fence material. A home gardener in Chetto experienced that people left for devil's claw harvest and nobody took care of the community garden.

There was a lack of monitoring during the projects. The majority indicated that they would have needed more support and training. Only one respondent indicated that she got enough support.

Other challenges mentioned were the lack of customers and too small area for gardening. The gardener members in Pipo indicated that they did not receive vegetable seeds again

after the first harvest and, therefore, could not continue gardening. Also, interviewees from Omega III and Chetto indicated that the lack of seeds was a challenge and a barrier for continuity.

The fence of the community garden in Omega III was destroyed by elephants after planting maize in the garden in the rainy season. Elephants came inside the garden easily and consumed the harvest of maize and others. After the fence was destroyed, domesticated animals got easily inside the gardens and grazed the harvest. The fence of the community garden in Pipo was not build properly due to the building material. The poles were not dense enough; hence domesticated animals came easily into the area.

5.5. Gardening Workshop

5.5.1. Socio-demographic Data

The average age of the interviewees who participated in gardening training was 27 years, the youngest being 21 years old and the oldest 32 years old (Table 4). Two of the interviewees received salary during the field research and only one had not attended in school.

Table 4. Socio-demographic data of gardening training members

ID #	Gender	Age	Village	Salary	Grade
23	Male	27	Mashambo	Yes	10
24	Male	23	Mashambo	Yes	8
25	Male	25	Tonxei	No	8
26	Female	36	Poca	No	-
27	Female	32	Chetto	No	7
28	Male	21	Chetto	No	12
29	Male	30	Poca	No	9

5.5.2. Motivation

The motivation to participate in gardening training or workshop was to gain gardening knowledge and start gardening on their own. The majority wanted to learn how to make

a garden. Only one of the interviewees emphasised specific things that he wanted to learn, such as how to save seeds from harvest and rotate plants. Food and income were mentioned only by one respondent. The participants of the gardening workshop were selected by the headman and a chairperson of Kyaramacan association.

5.5.3. Outcome of Gardening Training

The gardening training lasted a period of two weeks in Omega I while other gardening trainings were provided in the villages where participants lived. When asked what they learned during the training, many different things were mentioned from sowing seeds to storing and selling harvest. The majority of the interviewees mentioned that they did not receive any support after the training and no monitoring was provided afterwards. Nonetheless, all participants were satisfied with the outcome of the gardening training even though they did not get support afterwards. The participants of the garden workshop received a gardening booklet (Figure 15) but only one still had it during the field research.

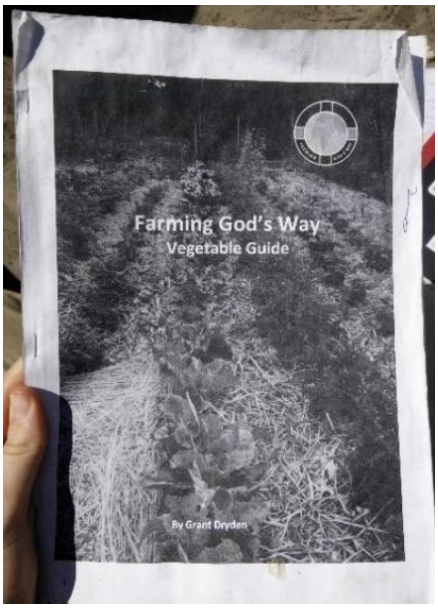

Figure 15. A gardening booklet provided by the garden workshop.

The participants were told that they should go back home and start gardening and teach others. Two out of seven tried growing sweet potatoes after their gardening training and one of the interviewees got harvest of six sweet potatoes. Another interviewee was growing sweet potatoes during the field research. Six of the interviewees mentioned that they could not try gardening because they did not have seeds and it was impossible to

purchase them due to their high price. Three out of seven saw the water availability as a challenge for starting a home garden of their own. They mentioned that water transportation is not easy. One interviewee commented that if there was water close to her house, she would make a garden. Also, not having tools was mentioned by most of the interviewees as a reason for not having a home garden.

Everyone still wanted to be more trained in gardening activities even though they already gained experience from training. Five out of seven stated that they want to refresh their memory about gardening. One of the interviewees mentioned that he wants to know how to make good and strong fence.

5.6. Non-gardeners

5.6.1. Socio-demographic Data

The average age of unexperienced gardeners was 25 years; the youngest was 19 years old and the oldest 34 years old (Table 5). Six of the respondents were woman. None of them received any salary and only one had never attended school.

Table 5. Socio-demographic data of residents with no gardening experience

ID #	Gender	Age	Village	Salary	Grade
30	Female	35	Mashambo	No	5
31	Male	19	Mashambo	No	10
32	Male	31	Mashambo	No	9
33	Female	19	Mashambo	No	7
34	Female	21	Mashambo	No	6
35	Female	15	Tonxei	No	-
36	Female	34	Poca	No	8
37	Female	34	Poca	No	6
38	Male	28	Chetto	No	8

5.6.2. Motivation

The motivation of the non-gardeners for starting a garden of their own would be getting relish and income. Vegetables were found to be healthy and good to eat as a side dish with maize meal. The majority of the interviewees would increase their income by selling vegetables for the other community members and people who are passing the villages by

cars, such as tourists along the road. One of the respondents was planning to sell his vegetables in Kongola where especially tourists stop by at the gas station. In addition, vegetables could be shared with other community members who do not have relish.

Two of the interviewees stated that they want something to do and not just wait for someone to come offering a job. One of the interviewees in Poca stated:

"It would be like self-employment. I want to employ myself."

5.6.3. Gardening Knowledge

The interviews of non-gardeners showed that they had general knowledge about gardening, but more specific information would be needed to manage a home garden of their own successfully. Also, inputs would be needed.

The majority of the interviewees would set up their garden near the borehole where the water was near and carrying water long distances could be avoided. Only three considered their own backyard as a good location for a garden. This would remove the challenge of other people stealing their vegetables while they can guard them more easily.

When asked what kind of soil would be good for gardening, four out of the nine interviewees mentioned loam soil. Three of the interviewees mentioned that any soil would be good if you mix it with manure. The majority stated that goat manure can be used as a fertilizer in gardens. Also, donkey's manure was mentioned by two interviewees. Six out of nine indicated that crop residues can be used as organic manure to improve soil fertility. Over half of the interviewees considered that a suitable time for applying manure was just before planting, and only once. Two out of nine mentioned twice and one respondent indicated that it is important to use manure daily. However, specific amounts of manure were not mentioned. Manure was said to be easily available everywhere and free of charge if you would collect it by yourself.

Five of the interviewees believed that they would know what to do if there were insects in the garden. Four out of nine would buy pesticides from a shop in Katima Mulilo. The use of traditional medicine was mentioned by two interviewees.

5.6.4. Why Not Garden

The non-gardener's point of view was that there would be many different challenges in gardening, such as domesticated animals that could damage their vegetables. Lack of tools, seeds, fences, and water as well as stealing and insects were also mentioned as possible challenges. However, two of the interviewees emphasised there are no challenges at all.

When asked about the reasons for not having a garden, four out of nine said they did not have seeds and it would be impossible to get them. Two interviewees mentioned that they did not have necessary tools needed in gardening. Tools could not be purchased because they did not have money. An interviewee from Poca stated:

"I need tools, but nobody is giving me them."

All interviewees mentioned that they would need some tools in gardening. Tools such as a digging fork, a watering can, a rake, a spade, and a wheelbarrow were mentioned most frequently. When asked where these tools can be acquired, five of the interviewees mentioned that there was not a place where to get tools while three of the respondents emphasised that tools could be purchased from a shop in Katima Mulilo. A young resident in Chetto indicated that some tools could be made from branches and the building material would be in the bush. Also, borrowing from the local people was mentioned to be an option.

Six interviewees mentioned that seeds could be purchased from a shop in Katima Mulilo. In addition, the option of receiving seeds from the agriculture extension officer was considered because the previous agriculture extension officer could have given vegetable seeds.

5.7. Gardening in Bwabwata National Park

The possible difference between gardening inside the BNP and outside was asked from all the 38 interviewees. The opinions of the interviewees about the difference varied. The majority of the interviewed home gardeners found that gardening inside the BNP was

different but then the majority of the interviewees who had never had a garden found that there was no difference. A significant link was found between whether the respondent had or had had any kind of garden and whether gardening was different inside BNP ($p < 0,011$). The non-gardeners stated that people in the park grew same vegetables and could get the same harvest from their gardens than the people in Katima Mulilo. Also, the same gardening techniques and seeds were used. There was not a significant link between a gender and whether the interviewees found that gardening was different inside the BNP than outside ($p > 0,252$).

Reasons for differences stated by the gardeners were markets, equipment and wildlife. The residents did not have proper equipment such as irrigation technology, and transportation was expensive. There were not enough customers in the park unless the vegetables were sold along the road for tourists and others who passed the villages by car. Few of the interviewees indicated that there was more wildlife such as elephants inside the park and it affected the amount of harvest.

5.8. Future of Gardening

5.8.1. Gardening Training

When asked about the willingness of receiving gardening training in the future, 35 out of 38 indicated their willingness to train themselves. Only one of the interviewees did not want to have training because she had a small baby. Two gardeners emphasised that they had received enough gardening training and they wanted to be the trainers teaching others. The majority of the interviewees wanted to learn the entire gardening process including everything; starting from sowing seeds and transplanting seedlings to selling the harvest. Most of the home gardeners mentioned specific things they wanted to learn, such as pest management.

5.8.2. Type of Garden Wanted in the Future

When asked about what kind of garden is wanted in the future, 33 of all the interviewees answered. The majority wanted to have home gardens (Figure 16). One of the interviewees stated that he wants to have a project where he can teach others about gardening. Reasons for willingness to have home gardens were mainly related to the

challenges of the past community gardens such as conflicts, jealousy and stealing. A home garden would be easier to manage, and decisions can be made by the owner of the garden. A community garden member stated his willingness to have a home garden:

"I prefer my own garden because in a community garden, the problem is lack of cooperation. If we are together, there will be many conflicts."

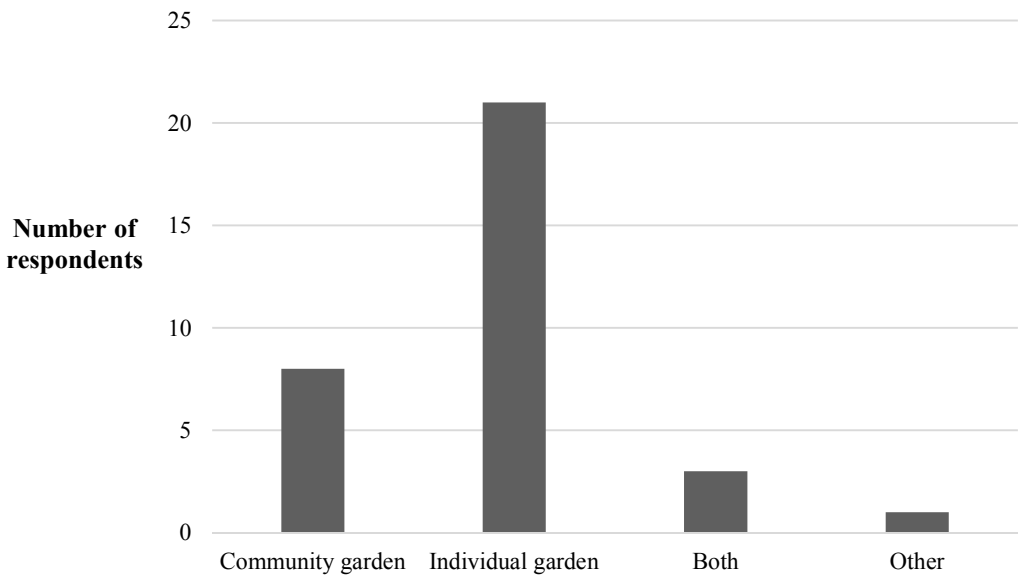

Figure 16. Type of garden wanted in the future

5.9. Garden Survey

5.9.1. Socio-demographic Data

37 home gardeners answered the survey. Majority of the respondents were from Chetto. 17 out of 37 respondents were new gardeners. Over half of the gardeners were men. The average age of the male gardeners was 31 and for the female gardeners 40. The youngest respondent was 17 years old and the oldest 67 years old (Figure 17).

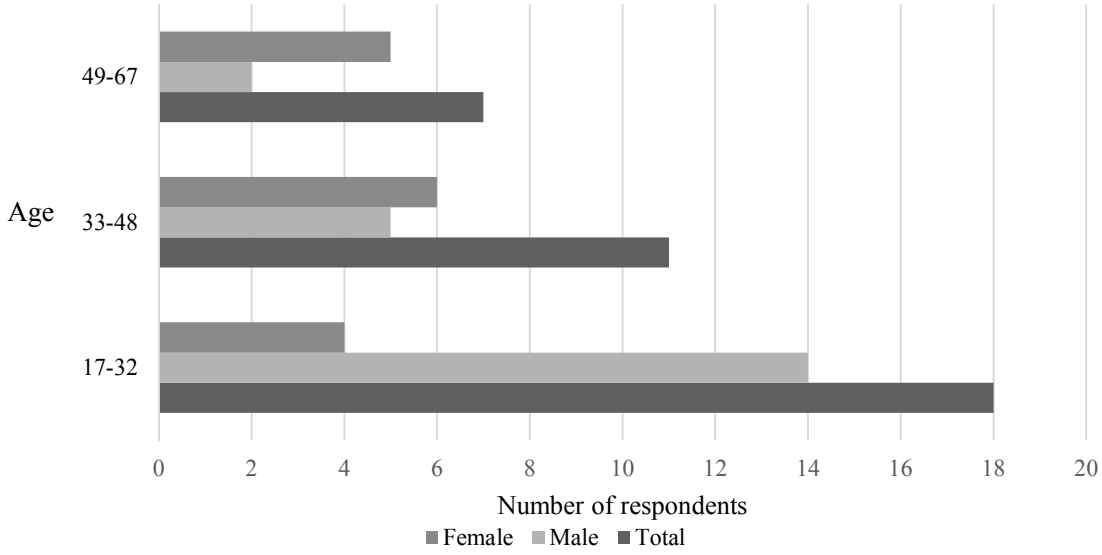

Figure 17. The age distribution of respondents

5.9.2. Gardening

Reasons for gardening were clearly creating income and obtaining food (Figure 18). Other reasons included e.g. gaining experience and activity. Also, previous experience from a community garden was mentioned as a reason for establishing a home garden.

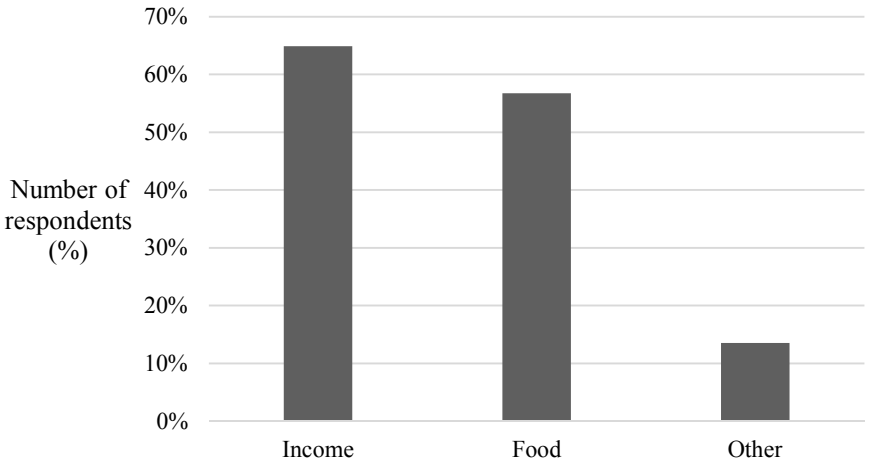

Figure 18. Reasons for gardening

Most of the respondents (78 %) had protection in their gardens. The most common building materials were poles and branches. Three gardeners in Omega 3 used old wire from the community garden to make a fence. Only five respondents did not have any

protection. A gardener in Omega 3 indicated that there was no fence, but someone was always guarding his garden. The majority of the respondents received assistance from their family members for making beds and watering the plots.

The most popular vegetables were cabbage (73 %), swiss chard (51 %) and tomato (49 %). Also, carrot, onion, beetroot and rape were mentioned. At the time when the survey was conducted, some of the gardeners had already consumed some vegetables from their gardens, such as cabbage and tomato, but majority was still waiting for the harvest. Only four respondents stated that they sold vegetables to others.

Ten gardeners indicated that they had problems with insects eating their cabbages. Other problems were the lack of water and manure, ants and grasshoppers as well as domesticated animals. Distances from gardens to boreholes in Chetto were measured. All together 27 gardens and 3 boreholes were involveed. The average distance from a garden to a borehole was 345 metres; the longest distance being 616 metres and the shortest being 155 metres.

Over half of the respondents (60 per cent) got seeds from the seed distribution. There was a seed distribution done by a local community member funded by the MLR in Chetto. 27 per cent of the respondents received seeds from somewhere else or bought them. The majority of the gardeners used tools in their gardens. Almost half (49 per cent) of the gardeners borrowed tools from other community members. Fifth used their own tools in gardening. The gardeners were asked about their needs in gardening. More than half indicated that they would need tools (Figure 19). The Survey showed that the majority borrowed tools from the family or other community members.

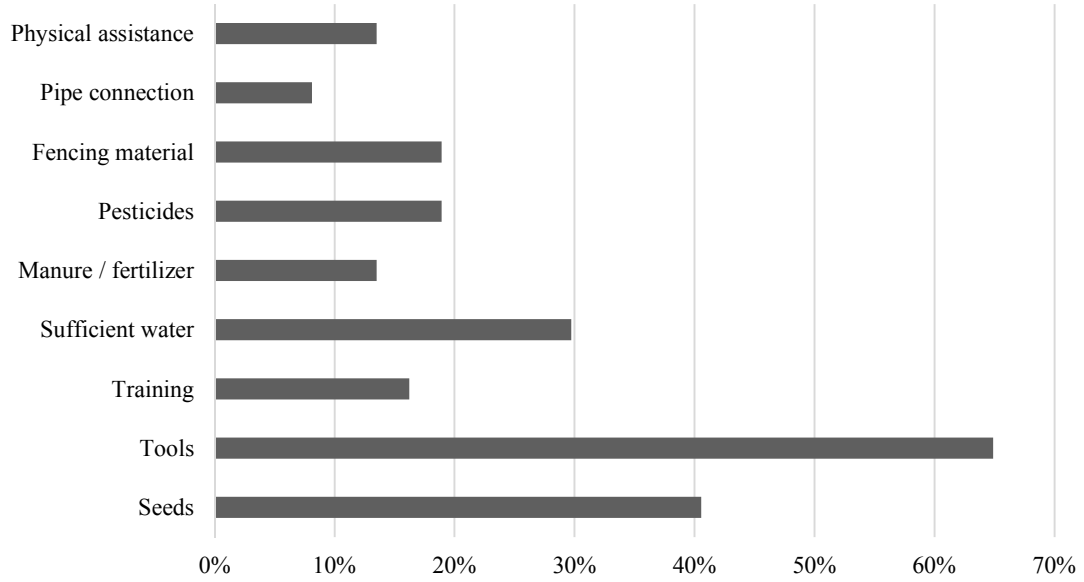

Figure 19. The needs of the gardeners

When asked about a desired garden type, 15 respondents indicated that they would want a home garden of their own. Some of the gardeners stated that community gardens did not operate well due to the lack of cooperation and stealing. However, 11 respondents would like to have both, a community garden and a home garden.

5.10. Stakeholders

During the interviews all stakeholders clearly stated that it would be significantly important to find solutions to help the Khwe San to have more food and to diversify their diets because the current food situation was difficult. It was also said that, currently, agriculture was more popular than gardening;

"*We do not depend on gardening, we depend on farming*."

Majority of the administrative officials indicated that the focus would be on community gardens, but it was not denied that home gardeners could not have been supported. Stakeholders admitted the difficulty of building a sustainable community garden project. There were challenges in the selection of garden members in the past because people wanted to be paid. The selection of participants would need to be done based on people's interest in gardening. Water was also a challenge and the issue would need to be solved.

"People think, it is the government who is not taking care of the garden."

There was a plan to revive community gardens in Omega 3 and Chetto and the budget was already reserved. According to the interviews, gardens could be revived easily because the fences and boreholes were already there. The plan would be to have two water taps in each community gardens to avoid water challenges. There would be one tap inside the garden for gardeners to irrigate their garden plots and one outside the garden for people to fetch drinking water. Previous community garden projects' monitoring was inadequate. The plan to revive gardens was to have more monitoring in the future. With an intensive monitoring, community gardens could be sustainable. The importance of having gardening training was also highlighted by different stakeholders.

An NGO indicated that they could support individuals, but in the first place they would start with groups. If cooperation is not functioning, they could shift the focus to home gardeners. The NGO stated that the main challenges of gardening in BNP are resources, such as supplies, and people do not have capital for purchasing seeds and tools which are needed at the beginning.

Different suggestions came up during the stakeholder interviews. The focus could be on mixed farming systems where vegetables and fruit trees are grown and domesticated animals such as pigs and geese are kept. However, most donors want to have group projects that would benefit more people.

5.11. Agriculture Teachers

During the field research none of the schools were having school gardens. Agriculture teachers indicated that having a school garden would be difficult because they do not have a fence or enough water. They also indicated that there are no field visits because there are no farmers or fields nearby. Also, transportation costs would be high. Some practical work such as familiarize with the different kinds of soil is done during the lectures. Agriculture is taught at schools from grade 5 to grade 9. There were not enough textbooks for learners, so the teachers wrote notes on the blackboard.

When asked about the most important topic in agriculture, business management, general agriculture and the history of agriculture were mentioned. It was said to be important knowing about business to get clients and earn money. The history of agriculture was stated to be important because it teaches the learners how people survived in the past.

5.12. The Resources of Sustainable Rural Livelihoods

Physical and Natural Capital

The biggest challenge for sustainable gardening among the Khwe was clearly water. One of the limiting factors was that there were only very few water points in the villages, e.g. one borehole in Pipo and one in Tonxei. The distances were long and the physical load of carrying water for a long distance was presented. The water was used from the boreholes which were drilled in the past. Water supply was depending on the boreholes because there were no rivers or lakes near and there was no water supply network in the villages. The interviews showed that the water coming from the boreholes was not enough for individual persons, gardeners and domesticated animals.

Many of the Khwe stated that the bush is prohibited, and hunting is illegal, which means the veld food and wild meat are not consumed as part of the daily meals anymore. Wildlife such as elephants were harming cultivation. Elephants were not a big challenge for the home gardeners. However, they destroyed the fence of the community garden after planting maize in Omega III.

There were no markets for vegetable products except selling vegetables to other community members in the villages. However, the infrastructure included a road and especially tourists are passing through the National Park moving from southern Namibia to Zimbabwe and Zambia. Seeds were often purchased from the nearest market city in Katima Mulo. However, the transportation costs were found to be high, and it was difficult to get a ride by hitchhiking.in the East BNP. The challenges mentioned during the interviews were lack of seeds, fence and tools as well as domesticated animals. There was not seed distribution during the field research.

Human and Social Capital

The attitude towards gardening was positive but, at the same, people were not trying gardening due to lack of seeds or tools. The education level of interviewees varied; younger people have attended in schools whereas older people have not. Agriculture is taught at schools, but no school gardens were operating during the field research. In addition, the opinions of agriculture teachers varied, e.g. one of the teachers stated that livestock management including cattle is the most important topic. However, cattle are not allowed to be kept in the East BNP. Gardening knowledge was gained from the schools, trainings or community gardens. Gardening training was provided for the selected people, but they failed to manage their own gardens. However, the majority of the interviewees stated the need of more training on gardening activities. The interviews showed that there had not been enough monitoring. There was not an agriculture extension officer after the field research. The major challenges in gardens, especially in community gardens, were jealousy and stealing. Some of the interviewees indicated that the tools given by the GRN belong to everyone and not only to community gardeners.

Financial Capital

People did not have financial capital to purchase seeds or tools due to high unemployment in the area. The majority of the people did not have jobs; thus, they did not receive any salary and they did not have access to credits. The older people who have birth certificates received pensions. Due to lack of financial capital, people could not purchase vegetable seeds and tools to start gardening.

6 DISCUSSIONS

6.1. The Gardeners

Surprisingly, majority of the interviewed gardeners were young men, but gardening is seen, however, to engage more women (Torimiro et al 2014). The study about home gardens conducted in South Africa showed high involvement of men when the garden produced enough and an opportunity of income by selling it was occurred (Zimpita et al. 2015). A similar finding was done where more men were participating in homestead food garden programme in South Africa (Tesfamariam et al. 2018). The high involvement of men might be explained by their willingness to gain income as their motivation for gardening was not only relish but also income. Similar findings were found by Ngome & Foeken (2012) in Cameroon and Yiridoe & Anchirinah (2005) in Ghana. Another explanation for low participation of women in gardening might be that they are busy with cooking and collecting firewood and also looking after children (Boden 2014). Furthermore, their education levels are much lower than men's.

The average age of all the interviewed groups was less than 35 years old, except amongst community gardeners. However, the majority of the community gardens operated near ten years ago when gardeners' average age was approximately 31 years, hence they fit in the same age range. Torimiro et al. (2016) found similar results in Botswana, where the majority of the small-scale gardeners' ages ranged between 30 and 35 years old. These age ranges were seen as active ages (Torimoro et al. 2016). Nevertheless, the research in Benin showed that involvement of older people in gardening is more common because demanding physical activities are not required in gardening (Gbedomon et al. 2015). However, mostly the elder are cultivating e.g. maize which is more demanding in physically. The gardeners' young age may be explained by the fact that especially the elders have learnt farming, such as corn production, in the past and have become farmers. Boden (2014) discovered that the confidence of elders in vegetable gardening is not the same in crop production in BNP. This might have influenced on the result that the young are trying gardening more than the elders.

6.2. The Impacts of Gardens on Food/Household Security

The importance of gardens in getting relish to diverse the diets and gaining income was clearly indicated in all interviews, including the stakeholder interviews. The motivation of home gardeners as well non-gardeners for starting their own garden and participating in a community garden were mainly the same, to get relish and income. According to Jones & Dieckmann (2014), veld food from the bush has been an important source of relish for the Khwe but, currently, due to prohibition of the bush, relish needs to be acquired from elsewhere. In addition to prohibition, the harvest of agricultural crops in 2017 was very low or nothing and people depended highly on food aid. Gardening was seen as a new solution to diverse the residents' diets.

The selection of vegetables was done based on their physiological properties and communities' interest among the home gardeners and community gardeners. Similar finding was done in Botswana, where the selection of vegetables was made based on their fast-growing properties and market availability (Torimiro et al. 2016). Surprisingly, nobody has tried to grow medicines or spices in their gardens even though traditionally home gardens are seen to be not only the source of food but medicines and spices as well (Gautan et al. 2004). This might be explained by their traditional methods to gather medicines from the bush (Dain-Ownes et al. 2010) in the past as well as their short experience in gardening (Boden 2014.

Home gardens' impact on food security is hard to indicate due to the time of field research. The home gardeners were only at the beginning of the preparation. Nonetheless, many of the respondents indicated that they got harvest and one home gardener in Mashambo stated that he did not have to purchase additional food during the vegetable season. It can be assumed that home gardens have had positive impact on the residents' diets. The interviews showed that people have also sold part of it to other community members. The home gardeners did not mention how much they have earned money by selling vegetables; hence it is difficult to estimate the real impact of vegetable sale in their economic situation. Torimiro et al. (2016) found that income gained by selling vegetables produced from home gardens was inadequate to buy other crops.

Community gardens operated only for a period of one harvest in Pipo, Omega 3 and both gardens in Chetto. The community gardeners got only one harvest, if any, before the

gardens started collapsing. The gardeners either consumed the harvest by themselves or sold part of it to other community members. It is common that part of the harvest is either sold or exchanged with others (Torimiro et al. 2016).

There is not much evidence available about the community gardens' impact on food security (Shisanya & Hendriks 2011). Community gardens did not have a significant contribution to food security of a household in research in South Africa, but its impacts for families that depended on GRN support could not be entirely denied (Shisanya & Hendriks 2011). Community gardens of the San in Botswana did not have significant influence on gaining income or relish due to the size of the gardens (Cadger & Kepe 2013) whereas an urban community garden in Zimbabwe instead had a positive impact on providing food security for people who have faced negative instability (Sithole et al. 2012). Based on this study, it is hard to indicate whether community gardens have had a significant impact on residents' food security because they operated only for a period of one harvest and, currently, they are abandoned. In addition, the respondents could not indicate how much they got harvest, or they did not remember as they operated a long time ago. Due to high unemployment and dependence on food aid of the Khwe, it can be said that the community gardens had impacts on people's diets at least momentarily.

6.3. Challenges in Gardening

6.3.1. Community Gardens

Community gardens in southern Africa have faced many similar challenges and constraints than community gardens in the East BNP such as poor management (Chazovachii et al. 2013), water scarcity (Cadger & Kepe 2013) and vandalism (Sithole et al. 2012) as well as conflicts within community gardens (Chazovachii et al. 2013).

Interviews showed that the enjoyment of working together within community gardens was occurred. However, there were conflicts and jealousy among the participants as well with the other community members. According to Parry et al. (2005), community gardens may be more about community than gardening itself. This might have caused conflicts among the participants as well with the other community members in BNP. For instance, the sufficiency of water for gardeners, livestock and other community members caused conflicts about the issue who deserves to use boreholes. In addition, due to high

unemployment of the residents, people might have had more time become listless easier. The community gardens were mainly established in bigger villages where more people benefit from it, except Pipo. Community gardens could not involve all members from each village, thus, the thoughts about others benefitting more than self might have increased.

There were not any payments for gardening members within community gardens. Therefore, some of the participants experienced this negative and were not receiving any benefits from the project while others were happy working together. According to Parry et al (2005), community gardens can be places where people work together towards a mutual goal. The negativity might be explained by the unclear purpose of the community gardens. In Botswana, the purpose of community gardens was unclear and men, especially, indicated that they did not want to work without a payment (Cadger & Kepe 2013). Hence, if there will be a new community garden project, the aim needs to be clear for all participants as well as for the founder of the community garden project to make it sustainable.

Water caused conflicts for the gardeners as well as for the other community members. The major challenge in community gardens of two San communities in Botswana was water scarcity. The San communities of Botswana experienced water pipe breakages and the lack of fuel (Cadger & Kepe 2013. The water pumps in community gardens in Omega III and Chetto were solar pumps, and where people sometimes used the solar panels for charging their phones, it sometimes caused breakages.

Chazovachii et al. (2013) suggested in their research that other similar projects should be introduced together with community gardens in order to increase participation of community members. This could reduce theft and vandalism when people are busy elsewhere. However, there have been many projects in BNP, but those have been very different than gardening and they also operated for a short period of time. It is hard to say whether either of the previous projects has operated simultaneously with community gardens.

Most participants would have needed more support and monitoring in gardening. Several researches showed that community gardens are management intensive and time consuming (Parry et al. 2005). Community garden projects often need one or two persons

who can coordinate the activities of gardening members (Parry et al. 2005). In order to make a sustainable community garden project, more extension services need to be provided throughout a growing season. Matsa & Dzawanda (2014) indicated in their research that the monitoring should continue after the organizer has left the garden. A clear division of work among the participants is needed. The members need to be ready to engage in community garden. In the past, there have been many community projects, such as a bakery and a craft project, but none of them are operating anymore (Boden 2014). The unsustainability of the projects might be explained by that either monitoring has not been enough, or the people have not been dedicated enough. For instance, the community gardener members left the garden and participated in devil's claw harvest in Chetto. They might have thought that devil's claw harvesting is more important than the community garden. The income coming from the sale of devil's claw harvest might have been higher. In addition, devil's claw harvesting has been a part of their limited income sources for a long time. They might have experienced it more valuable income source. The community gardens might not have proved their capability in income generation due to their short operating periods and challenges. Also, the church which established the community garden in Pipo was not active in providing monitoring to the gardeners after the first harvest. Matsa & Dzawanda (2014) found that during the time the organizers are helping to establish community gardens, the knowledge and empowerment as well as confidence should be transferred to the gardeners. This might explain the unsustainability of community gardens. The community gardeners might not have gotten enough gardening knowledge or confidence to continue gardening alone. Also, the lack of seeds was one the reasons for the discontinuity of gardens. In addition, it is important to think about what the GRN and NGOs aim to achieve by establishing community gardeners. Monitoring is essential for the sustainability of community gardens (Matsa & Dzawanda 2014). The GRN should employ an active extension officer to monitor gardening as well as farming in order to make food production sustainable.

6.3.2. Home Gardens

The major challenges faced by the home gardeners were insects, water, fences and seed availability. Similar challenges were recorded in small-scale vegetable gardens in Botswana (Torimiro et al. 2016) and in Lesotho (Mokitimi et al. 2009).

Pests were one of the major challenges in gardening and the gardeners' ideas to prevent them were not many. They either used ash against pests or collected grasshoppers by hands. Removing grasshoppers manually is a traditional pest management method in low-income countries (Abate et al. 2000). The insect problem can be solved with good pest and disease management. Due to high unemployment among the Khwe, money is not available, and pesticides cannot be purchased from shops in Katima Mulilo. However, the PD gardeners used pesticides against the insects on cabbages and got harvest. More natural ways to prevent insects, such as planting biological pesticides, need to be taught. In a study conducted in Ghana, similar situation was presented but the gardeners used homemade pepper and garlic extract and it was found to be effective against pests of cabbage (Fening et al. 2014). Especially, using this kind of botanical insecticides can be used in small-scale home gardens where the needed resources can be grown with other vegetables in the same plot.

Water was challenging gardeners because there were only one or two water sources in the villages. The boreholes were far from the gardens and carrying water was indicated to be hard. The PD gardener solved the problem by connecting a water pipe from the borehole to his courtyard. However, this would need more inputs hence the majority of the home gardeners do not have financial capital. During the field research, a water pump broke in Mashambo and it was not repaired when the field research ended. These kinds of breakages influence gardens immediately (Hart 2011). The PD gardener had also prepared himself in case the borehole breaks down by having a water tank in his garden. Due to drought and poor water holding capacity of soil, vegetables easily dry up without water in few days. Drought resistant varieties can be used, and new methods can be introduced, such as keyhole gardening, where moisture lasts longer due to different layers (Mokitimi et al. 2009). In addition, more modern techniques, such as micro-drip irrigation, could be an option in the future when gardening is more common, and residents have earned money by selling their vegetables because the irrigation system is relatively expensive. It could have a positive impact on the amount of the harvest and in that way to household food security (Postel et al. 2001). Surprisingly, none of the gardeners mentioned grey water as a source of irrigation water which can be utilized in gardens (FAO 2004). This might be explained by the fact that people do not have the knowledge how to utilize it.

Poor soil was not directly mentioned to be a challenge for gardeners but, based on the observations and the gardeners bringing loam soil elsewhere, it was dry and poor around houses and it would need to be fertilized more. Surprisingly, Boden (2014) found in the interviews the soil to be very good, and the possibility of crop cultivation on the same field year after year was presented. Soil fertility can be improved by using crop residues as the majority of the home gardeners did. The gardeners used only manure from livestock although a household itself can provide organic manure by recycling. The PD gardener prepared compost to make soil more fertile. Some of the gardeners paid money for getting manure. The need of purchased manure can be reduced by using compost or other organic manure coming from a household (Keatinge et al. 2012). New techniques can be used to improve soil fertility such as adding legumes to the rotation (Keatinge et al. 2012) to improve the available amount of nitrogen in soil. In addition, unawareness about appropriate amounts of manure applied on gardens to improve soil fertility occurred among the gardeners. Goats and chickens are grazing around the villages and their manure, especially goat's manure, is easily available. Hence, livestock is very important in the area in terms of gardening.

The lack of fences and seeds were also mentioned to be challenging frequently. Fencing was challenging because the domesticated animal could easily come inside the gardens and graze it. Zimpita et al. (2015) made similar findings. Part of the respondents indicated that the building material for a fence is in the bush. However, if the bush is prohibited, fencing material is difficult or even dangerous to get. Lack of seeds was a limiting factor for continuity of gardening. The home gardeners did not have money to purchase them and the agriculture extension officer did not distribute vegetable seeds. In addition, the non-gardeners and participants of workshops stated that they cannot start gardening due to the lack of seeds. The gardeners in South Africa got their planting material from the community-based nursery (Zimpita et al. 2015). It can be considered whether this kind of solution could be an option. However, community-based nursery needs a manager and people to take care of it. It could raise similar challenges than the community garden projects.

The growing season of vegetables was clearly indicated to be in winter and it was indicated that it starts in May. The reason for this is unknown, but it might come from a school. During the interviews, it was seen that many gardening information, such as good soil for gardening, was directly coming from the agriculture text books which were used

at schools. Agriculture and other subjects are taught directly the way things are written in the books and the learners try to memorize topics. It is important to remember that gardening is not yet very common, and the knowledge is mainly coming from schools or past community gardens, or the home gardens of the neighbours. However, if the gardening season could be all-year round, food insecurity could decrease.

6.4. Community Garden vs. Home Garden

All discussed challenges and the discontinuity of community gardens might prove the fact that community gardens are not a reasonable approach to diverse diets of the Khwe in the East BNP.

Clearly, the majority of the interviewed Khwe wanted to have their own home gardens. Despite the willingness of the Khwe, a budget was reserved for reviving two community gardens in Omega III and Chetto. However, there was a budget already for a community garden in Chetto for accounting period of 2014/2015 (Boden 2014), but nothing was done. Even though the community gardens are easy to establish, and they are cost-effective in the initial stage, monitoring and evaluation requires much more (Chazovachii et al. 2013) whereas the requirements of the home gardens are not high and there is an opportunity to gain vegetable gardening skills at a low risk (Keatinge et al. 2012). The area for a home garden can be small and only few inputs are needed (Mitchell & Hanstad 2004). Due to the high unemployment of the Khwe, home gardening might be more suitable gardening method because major inputs and large land space are not needed.

It is important to remember that the majority of the residents did not receive salary or social grants, which means they could not purchase seeds or other needed equipment for making their own gardens. The Khwe are dependent on GRN support (Boden 2014, Jones & Dieckmann 2014, Cadger & Kepe 2013). The interviews of the home gardeners showed that there is a need for tools, but the garden survey addressed that the Khwe could make their own gardens if they had seeds and confidence as well as someone who monitors. Almost half of the respondents were new gardeners and about 60 per cent of all of the respondents received seeds from the distribution. Many gardens started to pop up after a seed distribution and close monitoring in Chetto. The seed distribution was funded by the MLR. This might prove that the Khwe are able to establish gardens of their own with only

a limited input. Consequently, if there could be distribution of non-hybrid seeds (in the beginning), gardening training and an active agriculture extension officer who monitors gardening and provides support for the gardeners, gardening can become more sustainable among all residents in each village.

Majority found that gardening was different inside the BNP than outside. There were no markets inside the national park, which means that gaining income was difficult. Vegetables, especially cabbages, were sold to other community members. People did not have much experience in marketing vegetables. Bwabwata National Park cannot be compared to any other place due to its uniqueness.

As Scoones (1998) has indicated, the roles of different institutions and organizations are important in terms of achieving a sustainable rural livelihood. The residents of BNP cannot improve their gardening situation without the support of GRN or other organizations. However, the form of assistance needs to be considered carefully.

6.5. Gardening Training

More gardening training was desired where they want to learn the entire process of setting up a garden. The interviews and observations showed that people have certain general knowledge of gardening. In addition, the non-gardeners seemed to have certain gardening knowledge even though they have never had gardens of their own. They have gotten it either from schools or adapted it from past community gardens as well as from a refugee camp in Botswana. There have had different kinds of trainings in the past, hence it is important to consider what kind of training is needed.

There was gardening training provided at the beginning of most of the community garden projects. The community gardeners did not mention the lack of skills as challenges, but Boden (2014) discovered that due to inadequate gardening training, community gardens in Omega III and Chetto started to collapse. Boden (2014) suggested that gardening training should be provided for dedicated persons. The interviews of the Khwe who participated in a garden workshop proved that the need for gardening training needs to be considered again due to an unsuccessful outcome; only two respondents tried to grow sweet potatoes afterwards due to the lack of needed goods such as seeds.

If there will be gardening training provided, the focus must be on specific subjects such as fence building, pest and disease management, soil and water management. Also, training is needed on how to save seeds from the harvest for the next season because it was indicated to be the biggest challenge when starting your own garden. Especially, training on prevention of pests would be necessary because most of the gardeners had problems with insects and, clearly, the most cultivated vegetable was cabbage which is prone to insects. Due to extremely dry conditions and water scarcity, training on drought resistant vegetable and different gardening methods, such as keyhole gardening, need to be considered. Two of the respondents expressed their willingness to be trainers. It could be a good option to employ these people as trainers or extension agents because they live in the park near people who need help and monitoring.

The ideal situation would be if there was a demonstration garden where training is provided when each phase takes place in gardening. The demonstration gardens are seen as an effective way to teach people (Faber & Laurie 2011). All different gardening practices could be trained concretely. However, this kind of training is demanding for the organizers. The location for a demonstration garden needs to be in a central place. For instance, it could be a school garden where the learners can take care of it as a part of their agriculture lessons and gardening trainings can be kept for the individuals. It was shown that school gardens have positive impacts on learners' knowledge about vegetables and their healthiness (Parmer et al. 2009, Laurier et al. 2017). During the field research, there were no school gardens in the East part of BNP. An NGO has established a small school garden in Omega III where learners take care of it by e.g. irrigating it (Agri Connexions Africa 2017). An establishment of school gardens might increase the number of gardens in the villages if the school garden is successful. The learners might take the idea to home and spread to their families (Laurie et al. 2017, Okiror et al. 2011). However, this kind of school garden might face the similar challenges than community gardens. If there will be school gardens, the person or persons who are responsible for it need to be committed. In addition, agriculture teachers also need to be ready to engage. They also need to have gardening knowledge to maintain the garden and teach in practice. Okiror et al. (2011) found that teachers' insufficient knowledge about management of school gardens is often a challenge. The issues like stealing and jealousy also need to be addressed in order to avoid similar challenges than in community gardens.

It is significant to remember that without any community garden projects people would not have gained knowledge about gardening. Adaptation is an important source of learning (Foster & Rosenzweig 1995). Community gardens have been a crucial source of gardening information for home gardeners, and some of the young gardeners told that they helped their family in community gardens and got an idea to have a garden of their own.

6.6. Limitations of the Research

The research included also a few limitations and constraints which are discussed here shortly. These might have had impacts on results and on the outcome of this study.

Some of the interviews were conducted directly in English without a translator. In retrospect, it would have been good to have a translator in each interview because then there would have been an opportunity for more specific answers from respondents because English was not their mother language. On the other hand, translation of the respondents' answers might have changed the real meaning. There were two translators translating interview questions. Both translators had their own specific way of working and one might have used different words than the other. At the beginning of the interviews with the second translator, I observed that he was correcting respondent's answers. This was quickly fixed during the interview by explaining that whatever the answer of the respondent is, it needs to be translated like it is said in Khwedam. Even though all interview questions were familiar to the translators, some of the respondents did not understand all the questions or did not want to answer. In these cases, the question was skipped, and the interview continued. In some cases, more specific question should have been asked; for instance, the amount of harvest from community or home gardens.

After each interview, all participants were asked whether they want to comment or ask something. Very often their questions were related to the benefits. Majority of the interviewees asked how they will benefit from my research and whether I will provide vegetable seeds and gardening tools for them. Of course, it is important to consider whether all answers are directly from interviewees' mind or whether they tried to say things that I wanted to hear about gardening. The information about the researcher doing her master's thesis in gardening spread fast in the villages. At the same time, it is good to

look into the garden survey data which was conducted after my field research. Over half of the respondents were new gardeners. It is difficult to say whether this research about gardening affected it, but it seems that willingness of having a home garden is clearly presented. The community gardens were established approximately 10 years ago. This might have affected the results of the interviews. People might have forgotten some details, or they remember some things differently.

The analysing methods used in this research were thematic content analysis, positive deviance approach and sustainable rural livelihoods framework. Positive deviance and sustainable rural livelihoods framework were used afterwards, and they were not considered to be used at the beginning. Hence, these methods are used here only to strengthen the understanding of the limitations of gardening as well as to show that gardening is possible in very complex environment without major support provided by GRN or other NGOs.

6.7. Research in the Future

More research is needed in the following subjects:

- How does a school garden in Omega III affect people's gardening?
- What is the real state of soil?
- How much are gardens producing and what is the distribution of harvest?
    - How much does the harvest from gardens contribute to food security?
- The effects of seed distribution on gardening
- How much do extension services contribute to the gardening or agriculture in the area?
- The relationships between the Khwe and governmental officials
- Natural pest and disease management

7 CONCULSION

The aim of the research was to determine gardening opportunities of the Khwe San as a part of their food security and livelihoods in the East part of Bwabwata National Park. The research has shown the importance of having gardens among the Khwe for food production as well as income generation. However, this study strengthens the facts about unsustainability and challenges of the community gardens in Southern Africa. The home gardens are the preference of the majority of the residents and the direction of the aim should be on individuals.

However, in order to make gardening sustainable, several activities are required. Monitoring is needed throughout and an active agriculture extension officer who visits the gardeners regularly. The training provided for gardeners need to include specific things such as water saving techniques and pest and disease management as well as fence building. The opportunity of establishing school gardens in every school in the East should be considered. In order to make sustainable gardens where the residents get nutritious food, boreholes need to be fixed fast if they break. Lastly, the GRN should continue the seed distribution either through an agriculture extension officer or a local community member who can monitor gardening activities as well.

It is important to remember that all people are not interested in gardening even if the research showed the importance of having gardens. It was seen in the community gardens that people left for devil's claw harvest and left the garden without management. There have been many changes in peoples' lives, lastly, the prohibition of the bush, hence the change of mindset takes time. They have needed to learn new ways to produce food differing from hunting and veld food collecting. Therefore, it is essential to find the people who are ready to commit and direct the gardening training and gardening support to them. When these people have received support, they can act as inspirations to others and spread the gardening information. Sometimes people need to see first that something is working before they can start it themselves. Small-scale gardening can have potential to increase food security of the Khwe with proper support provided by the GRN and NGOs.

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APPENDIX 1

Interview questions

Interview questions for all respondents

- Age
- Gender
- Education level
- Do you have a job?
- Do you think it is important to have a garden? Why?
- Have you ever had a garden?
- Have you participated in a community garden project?
- Have you participated in gardening training/workshop?
- Do you want to participate in a garden project in future? Why?
- How would you like to work? Alone or with community?
- If as an individual member, would you expect to get any assistance?
- Do you want to have training? What kind of training?
- Do you think gardening is different inside the national park than outside it?

Interview questions for the home gardeners

- What was the motivation to get involved in gardening training?
- Is/Was your garden fenced?
- Where do/did you get water for irrigation?
- What vegetables do you know?
- Do you think you can grow those vegetables here?
- How would you select vegetables that you want to grow?
- What vegetables are/were grown?
- Why are/were you growing these vegetables?
- Have/Had you eaten them before?
- How did you get the seeds?
- What kind of soil is good for gardening? Is/Was your soil that?
- Is it important to use manure? Why?

- Do/Did you use manure?
- What can you use as manure?
- Can you access to manure?
- When and how often do/did you need to apply manure during a growing season?
- If some insects are/were eating your plants, do/did you know what to do?
- What would you do/What did you do?
- How do/did you know when and how often you need to water plants in a garden?
- Do/Did you need any tools in your garden?
- What tools? Where do/did you get them?
- How do you know when is time to harvest?
- Can you do something for the crop residues? What?
- Do you think gardening is possible without any support from outside? Why?
- What kind of challenges do/did you face in gardening?
- What did you do when you did not have a garden?
- Do you plan to have a garden in this year?

Questions for the community gardeners

- Why did you participate in a community garden project?
- Was there any coordinator/manager in the project? If yes, who?
- Who was the donor/founder of the project?
- When was it?
- How were you selected? / How did you get involved in the project?
- Where was the garden?
- How did you work in the community garden?
- What was your job?
- What were other people doing?
- Were you working your own plot or with others?
- Were you satisfied with the way of working? Why?
- Was the garden fenced? How?
- Was the fence working through the project?
- Where did you get water for watering?
- What plants were grown?

- Why were these plants grown?
- Had you eaten those before? Which one?
- Who provided the seeds?
- How often did you go to the garden? Why?
- Did you have training? What did you learn?
- After training, did you get any support?
- What kind of support would you have needed?
- Were you satisfied with the outcome of the project? Why?
- How long did the project run?
- Why did it end?
- What were the biggest benefits of the project?
- What was the biggest challenge for you?
- Were there any other challenges?
- What would you have done differently?
- Can you describe your experience in the community garden project?

Questions for the participants of gardening training:

- Why did you participate in gardening training?
- Was there any coordinator/manager in the training?
- Who was the donor/founder of training?
- When was it?
- How did you get involved in the training?
- Where was the gardening training?
- What did you learn?
- After the training did you get any support? What kind of support?
- Did you get enough support?
- What kind of support would you have needed?
- Did you get a manual? What kind of manual?
- Were you satisfied with the outcome of the training? Why?
- What was the biggest challenge in the training? Why?
- Can you describe your experience in gardening training?

Questions for the residents who do not have any gardening experience:

- What would motivate you in gardening?
- Where would you like to make a garden? Why there?
- What kind of soil is good for gardening? Why?
- What vegetables do you know?
- Do you think you can grow these vegetables in the area? Why?
- How would you select the vegetables that you want to grow?
- Is it important to use manure? Why?
- What can you use as manure?
- Can you access to manure? How?
- When and how often do you need to apply manure during a growing season?
- If some insects are eating your plants, do you know what you need to do?
- What would you do and why?
- How do you know when you need to water plants in a garden?
- Where do you get water? How?
- Do you need any tools in gardening?
- What kind of tools and where can you get them?
- From where do you get the seeds? Are they expensive?
- How do you know when you harvest?
- Can you do something with the crops residues? What can you do?
- Do you think gardening is possible without any support from outside?
- What kind of challenges do you think you will face if you start gardening?